# APPROACH

## T·R·A·I·N·E·R

# PILOT MANUAL

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# APPROACH TRAINER

## INTRODUCTION

Congratulations! With the APPROACH TRAINER you have acquired an aircraft flight simulator training program which introduces you to the fascinating world of a modern passenger aircraft.

With the enclosed ILS approach charts in the original design as used by real-life Airline Captains you have the latest information on aircraft control and navigation available in the TRAINING MODE so that you can then reach as high a level as possible in the SCORING MODE in as many flights as you like. The results you achieve during the flights are entered in your personal log. In the MATCH MODE you can then measure your skills against an opponent. Through a series of five flights one can find out, which of the competitors is the more qualified pilot.

The APPROACH TRAINER is a supplement to the AIRBUS A320 flight simulator. The trainer program, however, does not assume, that you are already familiar with the AIRBUS A320 flight simulator.

# VIRUS WARNING

*The original APPROACH TRAINER diskette we supply is guaranteed free from all viruses.* ***Each time you want to use this program you should first switch off your computer and all other equipment connected to it (a second disc drive if fitted, the monitor etc.) for at least 30 seconds before you load the program. This is the only way to ensure that no virus has*** *remained in the computer's memory. The guarantee given by the manufacturer is null and void if any part of the program or its data is destroyed or affected in any way by a virus program, virus protector or similar tool.*

# COPY PROTECTION

The program is not copy-protected. Please therefore make back-up copies of the master diskette for you to work with and keep the original diskette safe. The following password prompt appears when you run the program for the first time:

**XYZ IS YOUR DESTINATION AIRPORT.**

**SET YOUR TRANSPONDER CODE ACCORDINGLY.**

**ACKNOWLEDGE BY 'Q'.**

Your target airport is displayed in place of 'XYZ'. You are prompted to set the relevant transponder code. Use the ILS APPROACH CHARTS for this. The transponder code to be entered is the altitude of the destination airport above normal sea level. You will find the correct value in the appropriate ILS APPROACH CHART at the top right, after 'Apt.Elev' (Airport Elevation).

Confirm your entry by pressing the [Q] key. Entering a wrong value will result in a blocked stearing until the correct value has been entered.

Let us use the example of the approach charts for Aarhus. At the top right you will see 'Apt.Elev.82'. This means the altitude of Aarhus above mean sea level is 82 feet, i.e. approx. 24 metres. You must therefore enter the number '82'. If the airport is located below mean sea level, such as Amsterdam, for example, which has an altitude of '-11', you simply enter '0' (zero).

To input the code, switch to the input mode with the left mouse button. The red indicator lamp on the input unit lights up. Then use the mouse to move the yellow cursor to the 'TRP' panel and press the left mouse button. The yellow panel turns blue. You can now input the transponder code.

Enter the code only with the number keys 0 to 9 on the main keyboard, NOT on the numeric keypad. In our example for 'Aarhus' you enter the value '82' as found in the ILS APPROACH CHART.

Now watch the input panel to the right of the red indicator lamp and only enter the next number

when the last number input appears there in blue.

You must delete any incorrect entry entirely, using the [C] key. You cannot correct individual figures either with the [Backspace] or [Del] keys.

Using the mouse, now move the yellow cursor to the [E] panel or press [Return] to transfer the value input to the transponder code panel [TRP]. This completes your entry of the password.

# TRAINING FLIGHT FOR EXPERIENCED A320 PILOTS

If you are a member of this group we have prepared for you a training flight. You will be familiar with much of this from your flights with the AIRBUS A320 flight simulator.

But this is not just a simple demonstration during which you can sit back in your comfortable armchair and just watch the computer doing everything. Instead, this is a full length flight with a landing at Amsterdam Schiphol Airport which you should complete in the training mode. You can use all the electronic aids available.

All new expressions are explained in detail in the following chapters. Simply do everything step-by-step as requested.

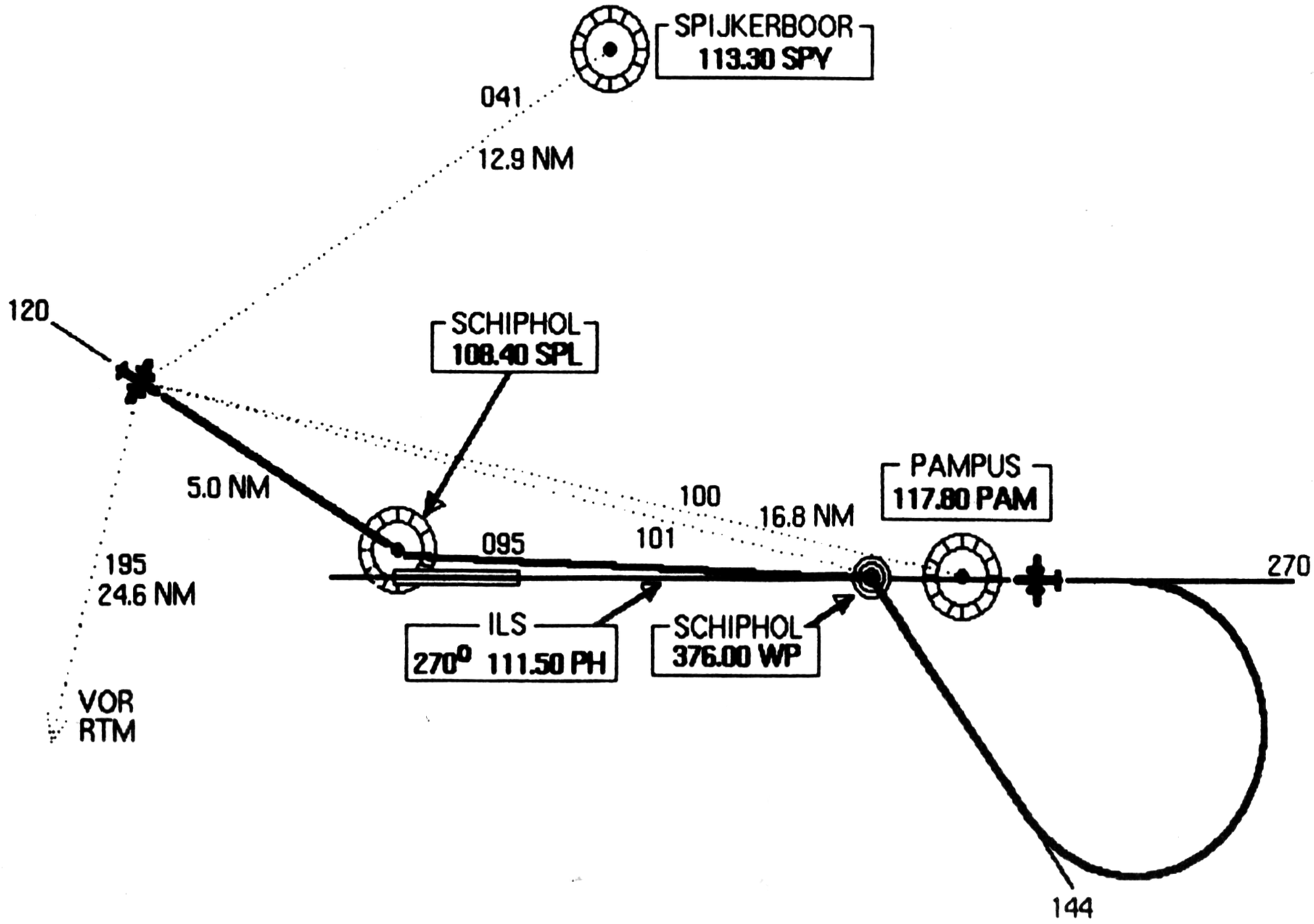
In contrast to the AIRBUS A320 flight simulator, in your approach you always start from the same position in the air, with exactly the same parameters. A new feature is available with the [R] (Repeat) key. Use this to interrupt your training at any point and repeat it again from the beginning. These two features enable you to undergo specific training in landing the aircraft.

However, on the ground the [R] or [Esc] keys respectively are only active when the Results Table is displayed, i.e. your aircraft has come to a complete standstill. This allows you to practice the same approach with different electronic aids or without any electronic assistance at all, until you can do it perfectly in your sleep.

So let's get started – you have a lot of flying to do!

Look in the ILS APPROACH CHARTS and find the page entitled 'AMSTERDAM, NETH. SCHIPHOL ILS Rwy 27'. To ensure you are not confused by all the detailed information it gives, the following simplified diagram shows just the points which are important for your training flight and some useful explanations.

Bild D1


SPIJKERBOOR
113.30 SPV
041
12.9 NM
120
SCHIPHOL
108.40 SPL
5.0 NM
100
16.8 NM
PAMPUS
117.80 PAM
095
101
270
195
24.6 NM
ILS
270° 111.50 PH
SCHIPHOL
376.00 WP
VOR
RTM
144

Repeated by klick on the MODE-field until it shows the DEMO-Mode active. The name of the airport at Amsterdam, 'SCHIPHOL', now appears. Click on 'OK' to load the training flight.

Please take your seat as the Captain of your airliner. Schiphol Approach Control have asked if you are ready to accept your landing permit. Confirm by pressing the [Q] key. You will be instructed to fly at an altitude of 3,000 feet above VOR SPL to NDB WP from where you will land on Runway 27 using the ILS.

Press [Q] again. This gives you the weather report: No cloud over the airport, flat calm, visibility more than 10 km, air pressure 1,013 millibars, NO SIG = 'no significant changes expected'.

You can now close the text window by pressing [Q]. Alternatively you can leave some of the text visible, perhaps that concerning your landing instructions.

Wait just a moment before starting your training flight. First have a look at the instruments.

The aircraft clock is shown at the top left: The time is 12:34 and a few seconds, which are displayed below it.

Next to this is your total weight, 49,700 kg, your fuel level, 2,990 kg, your fuel consumption per hour, 3,163 kg, and your required approach speed, 150 knots, (One knot (kt) is one nautical mile (NM) per hour and one NM is 1,852 metres).

Your landing course CRS is shown as 270 to the left above the navigation circle. You will also find this value on the ILS chart at the far right.

Your TAS (True Air Speed, i.e. your actual speed in the air, in our case also our speed above ground since there is no wind at all) is given as 221 kts.

Your altitude is shown at the top right as 3,500 feet (one foot is approximately 0.30 metres).

The gyro compass display is located below the artificial horizon. Your course, otherwise referred to as your heading, is 120 degrees magnetic.

Next to that you can see your RA (Radar Altitude) which gives your actual altitude above ground as '999'. The RA is determined by a radar distance measurement device. This shows your exact altitude above ground up to 999 feet. Altitudes over 999 are not displayed.

The other displays are not important at the moment and are explained in detail later.

You must now determine your position and decide what you have to do to be able to follow the instructions.

Several facilities are available for you for determining your position. The sky all around you is full of radio signals. You only need to use those that are important to you.

The input unit at the far left shows the three frequencies with which you select the relevant signals:

F1 111.50:
ILS frequency for Runway 27. This is only important for the landing.

F2 108.40:
This is the VOR/DME frequency at SCHIPHOL. It shows the value of the radial (the guide beam) as '120' in blue followed by V2 below the navigation circle at the bottom right. The distance from VOR/DME is shown in blue as '5.0' followed by NM. The blue pointer in the circle indicates your relative direction based on your heading.

DF 376.00:
NDB SCHIPHOL shows the radial above the navigation circle to the right below ADF as '101' in green and indicates the relative direction to the NDB by the green pointer in the circle.

The yellow OFF in the red panel indicates that you are not yet in radio contact with the radio beacon selected under N1 (ILS Schiphol).

The information given by VOR/DME clearly identifies your position. So you only need your direction, i.e. your course or heading. Details of your course are shown both in the circular compass display below the artificial horizon (12) and, in digital Form, in the centre above the

navigation circle (120). Your position and heading are therefore clear, as shown in the diagram.

Check the many different radio signals mentioned above. Press the left mouse button. A red control panel appears on the input unit at the far left for you to confirm your entries. Using the mouse, move the yellow cursor into the N2 panel and press the left mouse button. The panel changes to blue. On the keyboard, enter the number '11330' slowly. This is the frequency of VOR Spijkerboor. Then press [Return] to replace the previous frequency '10840'.

Watch the navigation instrument when you press the [Return] key. The blue pointer has moved. It now indicates VOR Spijkerboor and its radial 041. The V2 display at the right below the navigation circle indicates 041 and the distance shown is 12.9 NM.

This procedure is explained in more detail later. If you make a mistake, click the yellow mouse cursor on the [C] box (Correction) and repeat your entry.

Repeat this procedure with the frequency '11780' for VOR Pampus and the blue pointer will move to a different direction. V2 will show 100 and NM will read 16.8. The blue (V2) and green (ADF) pointers are now very close together, only a few degrees apart (100:101). Compare this to the diagram.

When you enter the frequency '11040' the blue pointer indicates VOR Rotterdam which is not shown on the map or the diagram. The radial V2 is then 195 and the distance is 24.6 NM.

Now reset these values to their previous settings. Enter a frequency of '10840' for N2 and terminate your entries by pressing the left mouse button. The red indicator lamp goes out.

This brief exercise which involves details which are given in later chapters should have convinced you that you are not wandering around totally alone high up in the clouds. In fact you can call upon the assistance of many radio beacons, covering all the 360 degrees of the compass. If all the radio beacons you could receive when flying at this altitude were shown on the display at the same time there would be far too much information for you to be able to see any details.

You can only receive three beacons at the same time, two VOR/DME and one NDB. With the equipment on board your aircraft you can receive, in addition to the NDB, either two VOR/

DME or one ILS/DME on NAV1 and one VOR/DME on NAV2. Not all NAV units are active at all times. Certain NAV stations may not be available for part of your flight or cannot be received, even if you have set the correct frequency, because your altitude is too low.

But as you have seen, just one VOR/DME is enough for you to clearly identify your position. If the DME (Distance Measurement Equipment) is not available, the intersection point of two VOR radials also indicates your position with sufficient accuracy.

This is enough information for the moment and you can soon start your training flight by pressing the [H] key (Hold Simulation).

We recommend you should use all the electronic aids available for your very first training flight. Press the [E] key to activate the EFCS (Electronic Flight Control System), then key [5] on the numeric keypad to execute the Hold Speed function and then the [Help] key to activate Seek/Hold. The blue indicators 'E' and 'S' above the artificial horizon will light up.

During your training flight you should use the [H] key (Hold Simulation) as often as you wish to pause during the simulated flight. You can then check anything and consider your further action before continuing. Simply press [H] again to continue. The next instruction from the tower reads as follows:

**PROCEED AT 3000 FT.**

**VIA SIERRA PAPA LIMA TO WHISKEY PAPA.**

**INTERCEPT ILS RUNWAY 27.**

The blue pointer in the navigation circle points straight up, i.e. you are heading straight for the VOR SPL. The values of V2, SEL and the heading are also correct.

You need not change course. But your altitude is 3,500 feet and you should reduce this to

3,000 feet by SPL.

Consider for a moment: At 212 kts/h you are travelling approx. 3.5 nautical miles per minute (212 divided by 60). So you need around 1.5 minutes for the 5 NM to SPL. You should reduce your altitude by 500 feet during this period. A vertical speed of 350 feet/minute (500 divided by 1.5) would bring you to the correct altitude in just about 1.5 minutes.

But you could also use a higher vertical speed of 1,000 ft/min, for example, which would bring you to the required altitude of 3,000 feet before you reach VOR SPL. This would then allow you to concentrate fully on changing course as required.

With one press on the [H] key you now accept full responsibility for around 50,000 kgs of passengers and materials in the form of your airliner. Push your mouse or your joystick slowly forwards, away from you. Note the numeric display to the right of the artificial horizon, indicating your vertical speed. This should lie somewhere around 1.000. You don't need to be accurate to within a few feet because you are not flying through a blazing hoop above VOR SPL like a lion performing at a circus ...

Your original engine power of 65% is reduced slowly to approx. 40% by the Hold Speed function. To the right below the navigation circle you can see that your distance from VOR SPL is reducing one tenth of a nautical mile at a time.

The moment you fly over the beacon the blue arrow suddenly shoots downwards (Beacon Swing). This indicates that VOR SPL is now behind you.

It's now time for you to change course as instructed by the tower: TO WHISKEY PAPA.

In other training flights you can start to change course one nautical mile before the beacon swing, so that you do not go too far south. This is because it's not that easy to force a 50 tonne aircraft onto to a new course.

But you should experience beacon swing at least once. Use the [Left] cursor key to start a gentle left-hand turn until the green ADF pointer is straight up. You are now flying towards NDB WP.

Your course to ADF is also shown numerically in green. You can select SEL as your preselected course with the [Left] cursor key and adjust it if necessary until both values coincide. When you have done this, press [H] and examine what has happened so far and what you intend to do now.

From the starting point you flew on a heading of 120 for 5 NM to VOR SPL and reduced your altitude by approx. 500 feet to 3,000 feet. You flew over VOR SPL, experienced beacon swing, changed course for NDB WP and now intend to fly there directly. When beacon swing occurs at that point you will change course to the right onto a heading of 144 degrees as per the ILS approach chart.

Continue simply by pressing the [H] key again. Immediately check your altitude and hold it at approx. 3,000 feet either with the mouse or the joystick. If all the other important information should ever make you to forget your altitude you will find yourself on the ground faster than you would like! No warning of a crash is given!

Approximately 1.7 NM before reaching VOR SPL you will come into radio contact with the ILS. A green diamond which can move from left to right appears on the navigation circle and shows your deviation from the landing course. A red diamond which can move up and down appears and shows your deviation from the glide path. A yellow diamond appears which shows your relative direction to the touchdown point. The yellow double pointer shows the direction of the runway and a red indicator appears in the yellow 'ILS' panel.

The V1 display then begins at 238 and the yellow diamond moves down slowly, showing that the touchdown point will soon be just behind you. The outer marker appears but is not important because you are flying away from the touchdown point. At approx. 8.5 NM from VOR the green diamond will start to move slowly away from the centre.

After the beacon swing above NDB WP you turn right onto a heading of 144. To do this, press the right cursor key until the preselected course 144 appears under 'SEL'. Then fly for approximately 3 miles (around 1 minute) on this heading.

Then turn onto a heading of OOO and fly at right angles to the final approach line. This is normal procedure during any final approach. As soon as the green diamond begins to move off centre, bank to the left onto a heading of 27O and adjust your course until the green diamond is in the centre. You will have then executed the last instruction given by the tower, i.e. INTERSECT ILS RUNWAY 27.

Now activate the INTERCEPT FINAL by pressing [Backspace] and experience your first landing controlled by the autopilot.

If at a later time you want to land your aircraft without electronic assistance and achieve a good result without any points being deducted you must manually control a number of parameters. The autopilot will now demonstrate this to you.

Please therefore pay special attention to the displays of the IAS, the ground radar RA, the slats and flaps, the vertical speed and the green and red diamonds. A vertical red bar next to the IAS display lights up if you brake the aircraft either in the air or on the ground.

A second possibility would have been to start a FULL PATTERN by pressing [Return]. You could have done this on making first radio contact with ILS but your chances of success would have been much lower.

To avoid crashing you should not forget to apply the brakes by pressing [Spacebar] after touchdown and/or reversing the thrust of the engines by pressing [O] on the numeric keypad. You must also keep the aircraft on the runway by left or right adjustments of the mouse or joystick. If you leave the runway at a speed of more than 5O knots you will inevitably crash. Switch off reverse thrust again with [.] on the numeric keypad.

When your airliner has come to a standstill the performance display shows an evaluation of your landing.

The chapter entitled EVALUATION explains the various individual points to you in more detail. The reasons for any bad result or a crash during your training flight are of course of great interest:

OFF RWY means that you touched down in front of, next to or behind the runway or ran off the runway at a speed of more than 50 kts. The same message also appears if you land correctly but on the wrong runway at the same airport.

GEAR quite simply means a belly landing. You forgot to extend your landing gear [F10].

SINK RATE is the vertical velocity which was too high on touchdown, as greater than 540 ft/min = 2.70 m/s.

PITCH is your angle around the lateral axis and means that the nose of the aircraft was too low and the nose wheel touched down first. The nose wheel itself is generally strong enough to withstand this but in the APPROACH TRAINER it is assumed that the nose wheel sheared off.

BANK is the angle around your longitudinal axis which means that one wing of your aircraft hit the ground on touchdown.

AIRPORT finally tells you that you landed somewhere other than at the specified airport.

Recall your training flight by pressing [R] and try to manage without one of the electronic aids. Try to manage without the Hold/Seek Heading function first, then without the EFCS and finally without the Hold Speed function.

If you wish to end your training session, press [Esc] to return to the main menu.

It will take some time for you to familiarise yourself with Schiphol well enough to be able to land there automatically, with or without any electronic aids. When you can do so, it is time for you to move on to the next chapter and train in flying to other airports.

# THE PHYSICS OF FLYING

Aircraft are by their nature heavier than air. For them to fly, we need a force which moves them forwards – the engines. If the engine thrust is greater than the air resistance and the drag on the ground, the aircraft will accelerate. If this force is equal, the aircraft rolls along at a constant speed. If the force is lower, the aircraft will slow to a standstill.

As long as the nose wheel is rolling on the runway the aircraft will accelerate well due to the low air resistance. As its speed rises and the nose lifts off when the elevator is adjusted, lift increases due to the higher angle of the wings and also the air resistance rises. Acceleration is therefore reduced. So it must be increased until the minimum speed guaranteeing safe flight is reached and this depends on the weight of the aircraft.

If the thrust of its engines is greater than the overall weight of the aircraft including its load of fuel and the passengers, luggage and freight it is carrying, the aircraft will lift off the ground. Friction along the ground then ceases and air resistance is reduced since the undercarriage can be raised and the slats and flaps can be reset.

The aircraft lifts off the ground and the engine power output can be reduced slightly. But where will the aircraft go? The captain has elevators, side rudders and ailerons or wing flaps available so that he can change the aircraft's direction.

He uses the elevator to control climbing and diving as well as maintaining height.

In the APPROACH TRAINER side rudders and flaps are always co-ordinated automatically. When the aircraft banks to the left the side rudder moves to the left, the slat on the rear edge of the left wing moves up and the slat on the right wing moves down. The left wing moves down and the right wing moves up so that the aircraft "leans into the curve". The rudders move in the opposite directions when the aircraft banks to the right.

Controlling an aircraft is quite different to controlling a land-based vehicle, for example a bicycle or a motor car. If you ride a bicycle in a curve you move the handlebars so that the wheel runs

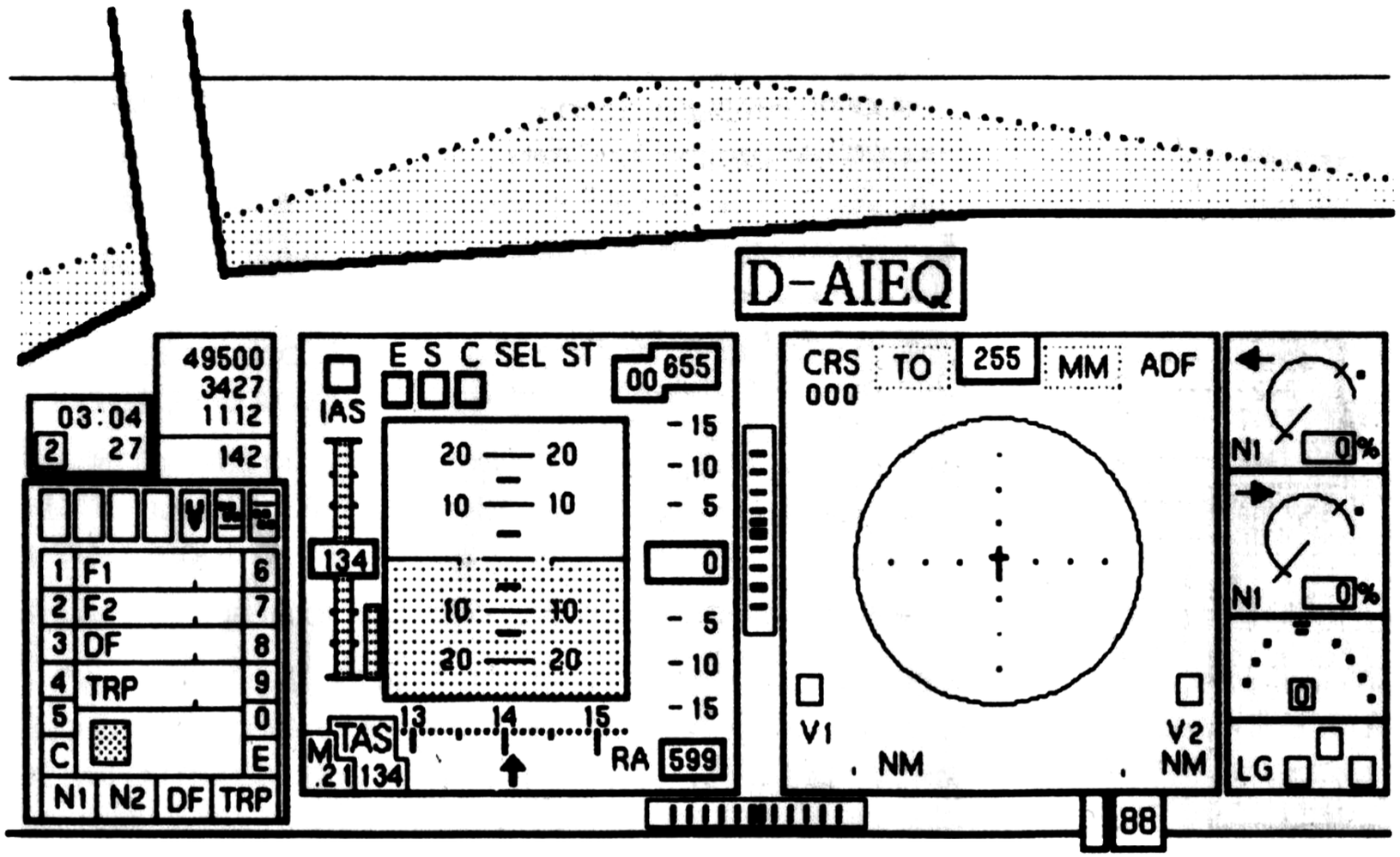
in the new direction. Then you set the handlebars to straight ahead again when your turn is complete.

At this point in time an aircraft would continue to fly in a curve. After reaching the curving flight line required and the appropriate amount of banking (leaning into the curve), the rudders would have to be centred again and this corresponds to your pointing your bicycle straight ahead again. But an aircraft continues to fly along the same curve until it is given 'opposing rudder' to take it out of the curve and make it fly horizontally.

As you do not need to be an aerodynamics expert this brief explanation is more than sufficient for you to be able to understand the rest of this program. If you are interested in the problems involved you will find lots of other material on this subject in public libraries.

# COCKPIT INSTRUMENTS

1

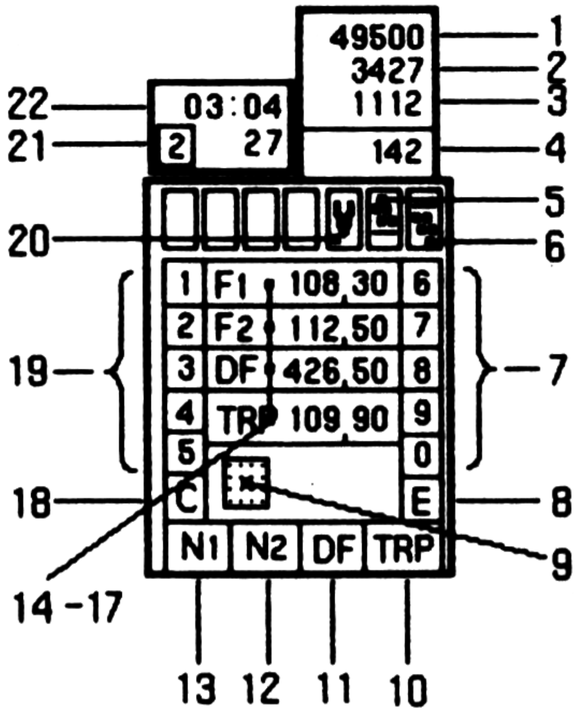


# INPUT INSTRUMENTS

2

left button =
input ON/OFF

left button
or number keys =
INPUT




1 = Present Gross Weight
2 = Fuel on board
3 = Present Fuel Consumption (kg/hr)
4 = Rotation-/Approach Speed
5 = I/O Activation for Ceiling
6 = I/O Activation for Pillow
7 = Number Entry Buttons 6-O
8 = Enter Value Button
9 = I/O ACTIVE-Indicator
10 = Selection Button for Transponder
11 = Selection Button for ADF-Frequency
12 = Selection Button for NAV2 Frequency
13 = Selection Button for NAV1 Frequency
14 = Transponder Code Display
15 = ADF Frequency Display
16 = NAV2 Frequency Display
17 = NAV1 Frequency Display
18 = Clear Entry Button
19 = Number Entry Buttons 1-5
20 = I/O Activation for Visibility
21 = Frame Rate Display
22 = Clock

### [1] PRESENT GROSS WEIGHT

The value shown in kg consists of the unladen weight of the aircraft and the weight of its fuel, passengers and freight. The maximum permitted weight for take-off is 73,400 kg and the maximum landing weight is 64,400 kg. During the flight the overall weight is reduced by the amount of fuel consumed. The display is updated in steps of 100 kg.

### [2] FUEL ON BOARD

This value shows the amount of fuel on board in kg, whereby 1 kg corresponds to approx. 1.2 litres.

### [3] FUEL CONSUMPTION PER HOUR

This value shows the fuel consumption in kilograms per hour for the present power setting and altitude.

### [4] ROTATION/APPROACH SPEED

On the ground this is the minimum speed which is essential, depending on the overall weight, before the aircraft may be lifted off the ground by raising the nose wheel with the rudder. After the take-off this indicator shows the minimum approach speed which also depends on the weight. During the flight itself this value falls gradually as the total weight of the aircraft decreases due to fuel being used.

***IMPORTANT NOTE FOR THE TRAINING MODE:***

*You must activate the input mode with the left mouse button to be able to enter the values for the following items [5] to [20]. The red indicator lamp [9] lights up. Then select the unit required [10] to [13] with the yellow mouse cursor and press the left mouse button. The panel changes to blue.*

*You can then enter the values required, either by clicking on the relevant numbers in rows [7] and [19] with the left mouse button or using the number keys [0] to [9] on the main keyboard (NOT on the numeric keypad at the right).*

*Do not enter the numbers too quickly when you use the keyboard. Watch the input panel to the right of the red indicator lamp and only enter the next number when the last number*

*you entered appears.*

*If you make a mistake and enter a wrong number you must cancel the entire number by clicking on the correction box [19] and re-enter it correctly. You cannot delete individual figures with the [Backspace] or [Del] keys.*

*The value entered is confirmed when you click on the input panel [9] or press the [Return] key.*

### [20] Input/output button 20 (Visibility)

You can adjust visibility at daytime only in eight stages from clear visibility (0) to thick fog (7). This facility is only available in the training mode. The basic setting for the cloud ceiling is 10,000 feet (3,000 m) so that with limited visibility there is also always a cloudy sky.

### [5] Input/output button 5, Cloud ceiling

This button is also only available in the training mode and allows you to change the ceiling altitude even during the flight. The values are shown in feet above ground (1 foot = approx. 0.30 m) and can be entered either with the mouse cursor or via the keyboard as normal. Take time to examine the different visibility conditions arising when you fly through the ceiling. To do this, select the different conditions one after the other with I O button [20], showing a "V" or with the key board button [V] (for visibility) or simply fly down through the cloud cover and observe the changing visibility conditions.

### [6] Input/output button 6, Pillow

As described above, this button sets the pillow altitude in feet above sea level. It can only be entered if a value of more than zero was input for the ceiling. If you have input the ceiling and then set or leave in a value of zero for the pillow, this creates a thin cloud layer starting at the ceiling and extending 250 feet vertically upwards.
In the SCORING and MATCH modes the ceiling is normally determined randomly in feet above ground and the pillow as a flight level in feet above normal sea level. In these modes these values cannot be altered.

### [7] and [19] Numeric buttons

By clicking the numbers in these two columns with the yellow mouse cursor you enter the values required in the input panel to the right next to the red monitor lamp [ 9 ]. When entering numbers the mouse does not affect the rudders. If you wish, you can stop the simulation by pressing [H] so that you can take more time to get your entries right.

### [8] Input activation

With this button you transfer the values entered via the keyboard or the numeric boxes shown right next to the red monitor lamp into the previously selected field [10] bis [13] or as the parameters for visibility, cloud ceiling or pillow. You can also enter the value by pressing [Return]. Both will de–activate the I O panel.

### [9] Red monitor lamp

The red monitor lamp tells you the system is ready to accept your input and also that the mouse is not controlling the rudder at the moment.

### [10] TRP transponder

The value entered here serves as a limited authorization check. The elevation of the target airfield, taken from it's APPROACH CHART, has to be entered.

NOTE: All frequencies must be input as 5–digit numbers with no decimal point or comma. (e.g., ADF=395 as "39500").

All frequencies must be input as 5–digit numbers with no decimal point or comma.

### [11] DF for ADF frequency selection button

Only click on this panel to enter the frequency for the automatic direction finder (radio compass). You use this to specify a radio beacon and a green pointer indicates its direction.

### [12] NAV2 frequency selection button

When you click on this panel you can enter the frequency of a VOR station (very high frequency omnidirectional range radio beacon).

**[13] NAV1 frequency selection button**

With this panel you can enter the frequency of a VOR or an ILS (instrument landing system) station.

**[14] TRP display**

If you first click on the box [10]TRP, the code entered is transferred to this field when you press [E] or the [Return] key.

**[15] DF: Display the ADF frequency**

The ADF frequency entered for the DF panel [11] is transferred to this panel when you press [E] or [Return].

**[16] F2: Display the NAV2 frequency**

The VOR frequency entered for N2 [12] is transferred to this panel when you press [E] or [Return].

**[17] F1: Display the NAV1 frequency**

The VOR or ILS frequency input for N1 [13] is transferred to this panel when you press [E] or [Return].

**[18] C: Cancel panel**

You can cancel an incorrect entry with this command. It is not possible to delete individual figures with the [Backspace] or [Delete] key. With [C] you can also de-activate a selection panel which you activated accidentally.

Normally the frequencies required are set at the beginning of each approach. For this reason you only need this information for "experimentation purposes", as demonstrated during your first training flight.

**[21] Picture rate**

This display indicates only the display speed of the program at the moment. Normally this will be '1' or '2' and therefore confirms that the program is running at the maximum picture rate. If more details of the landscape need to be displayed at the same time, for example the course of a river, a line of cliffs along the coast, a built-up area and an airport, the display indicator may vary between '8' and '9'. The program will then slow down noticeably.

If the program becomes too slow for you, you can disable the display of detailed information

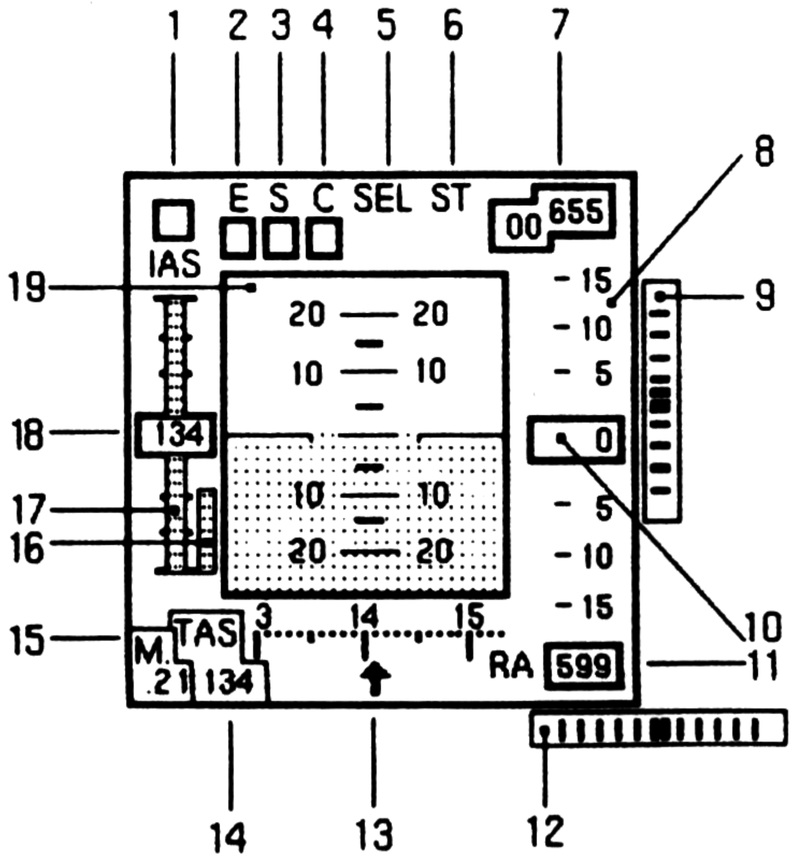
with [Ctrl] key. This will speed up the program again. You can switch the display of details on again by using the [Shift Left] key. The physical procedures during the flight are always timed correctly.

### [22] Clock

This display shows the time.

# ARTIFICIAL HORIZON

3




1 = Time Compression Indicator
2 = Electronic Flight Control System Indicator
3 = Hold-Speed Indicator
4 = Mouse/Joystick Selection Indicator
5 = Preselected Heading
6 = Stall Warning
7 = Altimeter
8 = Vertical Speed Indication
9 = Elevator Indication
10 = Digital Vertical Speed
11 = Radar Altimeter
12 = Rudder Indication
13 = Gyro Compass Display
14 = True Air Speed
15 = MACH-Display
16 = Air/Ground Brake Activation Indicator
17 = Indicated Air Speed Bands
18 = Digital Indicated Air Speed
19 = Artificial Horizon

### [1] PROGRAM ACCELERATION MONITOR LAMP

The APPROACH TRAINER runs in real time, i.e. one minute of the flight in the program lasts for 60 real seconds. By using the [F] key you can accelerate the program by a factor of 2. The red indicator lamp [1] lights up if this acceleration facility is active. In this way you can reduce the real flying time by 50%. The on-board clock then runs twice as fast.

As all processes are carried out at twice their normal speed we recommend that you press the key [F] again at the latest for the landing, to de-activate this acceleration facility.

### [2] E: ELECTRONIC FLIGHT CONTROL SYSTEM MONITOR LAMP

With the [E] key you switch the electronic flight control system EFCS on and off. When the system is on, the lamp [2] lights up in blue. The EFCS can only be activated when the engines are running and executes the following automatically:

- It regulates the engines at low speed to avoid a stall.
- The electronic system flies the aircraft aerodynamically. The horizontal and vertical deflections of the joystick are taken as input to the computers and interpreted as desired (nominal) values for bank and vertical speed respectively.

For landing, the EFCS is switched off at an altitude of 100 feet above the ground and therefore has no effect at all. It is activated at an altitude of 100 feet after take-off.

### [3] S: HOLD SPEED FACILITY

The key [5] on the numeric keypad activates the automatic speed hold facility. This keeps your true air speed constant. If the aircraft is flying up or down the power of the engines is automatically regulated accordingly. If you change the power of the engines manually with keys [8] or [2] the hold speed function is switched off. When you reach your new speed you must therefore press [5] again if you wish to use the hold speed facility again.

### [4] C: MONITOR LAMP MOUSE/JOYSTICK

You can switch to mouse or joystick control with the [J] key. The monitor [C] is black if mouse control is active, blue if a digital joystick is in use and yellow if you are using a Gravis Mousestick.
If you use a PC-type analogue joystick (see ANNEX), select "white" in the C-monitorfield.

***NOTE:***

*The resolution of the Gravis Mousestick programming unit (GMPU) should be set to 640 for the x axis.*

**[5] SEL: PRESELECTED HEADING**

If you press the [Help] key, your current course set on the gyro compass [13] appears below the SEL display. You also switsch the automatic SEK/HOLD HEADING facility at the same time. With the left or right cursor key you can set the course required under the SEL display [5]. This setting has an accuracy of one degree. Hold down the cursor key if you wish the values to change quickly. You can switch off the SEEK/HOLD HEADING function again with the [Del] key. Your aircraft responds instantly and turns onto the heading set.

**[6] ST: STALL WARNING**

An acoustic warning is given and the red STALL WARNING lights up shortly before your aircraft stalls because its speed is too low.

If you are in manual control you must immediately increase your engine power and/or reduce your rate of rise. If necessary you must turn the aircraft into a dive. If this warning appears just after take-off it may be that you have forgotten to raise the undercarriage and retract the flaps.

If the EFCS system is active it takes the appropriate action automatically.

**[7] ALTIMETER**

The altimeter indicates digitally the altitude of the aircraft above mean sea level in feet (1 foot = 0.30 m). After landing it shows the elevation of the airport above sea level. You cannot use this display for the landing itself unless you know the elevation of the airport above sea level. For this reason you should use the radar altimeter [11] for your landing.

**[8] and [10] VERTICAL SPEED**

The bars [8] of this instrument show graphically your rate of rise in blue and your rate of descent in

orange, in 100 feet per minute segments. If the blue bar is at mark 5 then your airliner is climbing at 500 feet per minute. As it is difficult to imagine anything by such a value, let us convert it into something which should perhaps make more sense:

500 feet/minute = 150 meters in 60 seconds = 2.50 metres per second.

If you therefore divide the value shown on the display [10] in feet per minute by 200 this gives you the value in metres per second.

The display [10] shows the absolute value of your vertical speed in blue for climbing and orange for descending to an accuracy of one foot per minute. If the EFCS is active, the automatic system keeps to the value you had selected with the mouse or joystick.

**[9] ELEVATOR**

This red display shows the angle of the elevator up and down. The higher the angle is up, the steeper your aircraft is climbing and vice versa.

The elevator has no effect when you are on the ground and when taxiing. During your flight you can examine its effect with the artificial horizon [18] and on the vertical speed displays [8] and [10].

If the EFCS is switched on, the red pointer remains in the centre and the effect of the elevator is only evident from the artificial horizon [18] and the vertical speed display.

**[11] RADAR ALTIMETER**

This instrument measures the exact distance of the aircraft above the ground, from 0 to 999 feet (300 m). It is an essential aid for landing. If it shows 100 feet above the ground, this is the lowest limit for the EFCS and below 100 feet you must control the aircraft manually.

**[12] RUDDERS AND WING FLAPS**

The red pointer shows the angle of the rudder and the ailerons. When the pointer moves to the left, the rudder moves to the left, the left aileron moves up and the aileron moves down. When the pointer moves to the right, the rudders move in the opposite direction. All three control surfaces are centred when the pointer is in the centre.

When taxiing, your aircraft is steered with its nose wheel. It will travel straight ahead if the pointer is centred. At the extreme settings the cockpit moves round in a circle and the main wheels rotate on the same spot.

In the air the position of the pointer gives you information about your bank angle and, depending on your speed and altitude, the radius of the turn and your angular velocity. When steering manually any deflection of the pointer means a change in bank. The pointer is centred when flying straight ahead or in a stable curve.

When the EFCS is switched on, the red pointer remains in the centre and the effect of the rudder is only evident on the artificial horizon [18] and the reading of the gyro compass [13].

**[13] GYRO COMPASS**

Your aircraft is equipped with a gyro compass which in contrast to a magnetic compass is not sensitive to magnetic fields and other interference. A high-speed flywheel which is mounted in gimbals maintains the original line of its axis at right angles to the north-south direction simply through inertia, even if your aircraft alters course. The new course is taken on by the gyro compass and is shown on the compass display [13].

**[14] TAS DISPLAY**

This shows the true air speed in knots. If there is no wind, i.e. a flat calm, this is, at all altitudes, identical to the speed of the aircraft over the ground.

**[15] MACH DISPLAY**

The speed is shown here in MACH. M. 1.0 means, that an aircraft is flying with a speed equivalent to the speed of sound in the surrounding air. The speed of sound is solely dependent on the absolute temperature (degree KELVIN). Since the temperature is decreasing with increasing altitude, M 1.0 is reached at low level with a greater TRUE AIR SPEED compared to high altitutes. A normal airliner is anyhow limited to approx M. 75.

**[16] BRAKE MONITOR**

A vertical red bar appears when the [Spacebar] is used as a brake in the air or on the ground.

### [17] and [18] INDICATED AIR SPEED

In contrast to the MACH display [15] this instrument shows a value in knots (1 knot = 1 nautical mile per hour). The value is determined by measuring air under compression. This does not represent the actual speed of your airplane in comparison to the air through which it is travelling unless your aircraft were flying at sea level in air at a temperature of 15°C. This is the standard or reference atmosphere.

Since the air pressure and density decrease as altitude increases, also air compression and therefore the IAS decrease at the same speed in relation to the surrounding air. Thrust and air resistance also decrease accordingly for the same reasons. At altitude the aircraft "behaves" aerodynamically just as it would with a sea level TAS equivalent to the IAS.

Put in a different way this means that at a higher altitude and a high TAS the IAS would fall to, say, 130 knots and this would result in your aircraft stalling if this also occurred at sea level with a TAS of 130 knots. The IAS is therefore a true indication of the aerodynamic conditions, i.e. the effect of the forces of the air, at any altitude.

The on-board computer converts the IAS into the TAS which is required for calculating your route and flight time. The vertical indicator [16] shows by its blue colour that a safe speed has been reached. The orange area means "Attention" and the red area means "Danger".

The digital display [17] shows the exact value of the IAS in knots.

### [19] ARTIFICIAL HORIZON

The most important instrument for quickly checking the altitude of your airplane around its longitudinal and lateral axes is the artificial horizon [18]. It gives you a view to the outside through an artificial window. The horizon line, the line between the orange and blue areas, shows the relevant flight situation. If it runs horizontally through the centre markings your airplane is flying horizontally and your pitch and bank angles are zero. The angle around its lateral axis (pitch) is shown in degrees and can be read with the aid of the 10° and 20° horizontal markings above and below the centre line.

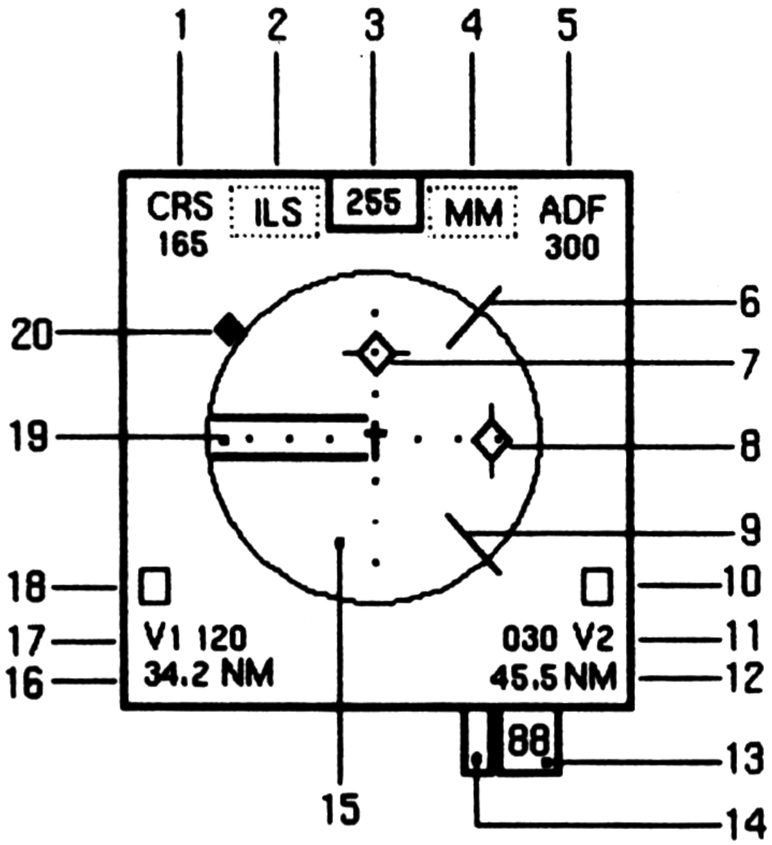
If your airplane is climbing, the horizontal line is below the centre line. If you are descending, the

horizontal line is above the centre line. Always try to imagine the airplane flying exactly in the middle of the centre line.

The angle around the longitudinal axis (banking) is shown by the angle of the horizon line. If the horizon line is 15° to the left, your airplane is flying at an angle of 15° to the right.

# NAVIGATION INSTRUMENT

4




1 = Selected Radial
2 = ILS/OFF – Indicator
3 = Compass Course/Heading
4 = Outer and Middle Marker
5 = Automatic Direction Finder Absolut Bearing
6 = ADF Course–relative Bearing (green)
7 = Glide Path Indicator (red)
8 = Centreline Indicator (green)
9 = NAV2 Indicator (blue)
10 = NAV2 Active Indicator (blue)
11 = NAV2 Radial (blue)
12 = Distance Measuring Equipment/
Distance to VOR2
13 = Evaluation Points
14 = Evaluation Active Indicator
15 = Navigation Display
16 = Distance Measuring Equipment/
Distance to NAV1/Touchdown Point
17 = NAV1 Radial (yellow)
18 = NAV1 Active Indicator (yellow)
19 = Course–relative Runway Display (yellow)
20 = Course–relativ Bearing to Touchdown Point
(yellow rhomb)

Normally the following frequencies and values are already preset as in-flight aids for determining your position for your approach:

- NAV1 = ILS as navigation aid for the final approach
- NAV2 = VOR frequency
- ADF = Bearing to the NDB

You became familiar with these facilities during the introductory training flight. They are explained here in the order in which they are needed.

**[15] NAVIGATION INSTRUMENT**

This circle shows all the optical indicators required for navigation.

**[3] HEADING**

This panel shows your course at the moment.

**[10] NAV2 MONITOR LAMP**

This lights up in blue if the NAV2 unit was activated by you inputting a frequency and the station involved is received.

**[11] BEARING V2 BLUE (RADIAL)**

This shows the magnetic course to the VOR as a figure in blue.

**[9] NAV2 POINTER, BLUE**

The blue pointer on the circle line is the direction to the VOR in relation to the current heading of the aircraft.

**[12] DISTANCE V2 BLUE**

This shows the distance to the radio beacon as determined by the DME. The numbers are shown in blue and represent nautical miles.

### [5] AUTOMATIC DIRECTION FINDER

The green pointer [6] on the circle line is the course indicator relative to the longitudinal axis. The absolute directions to the NDB is shown numerically in green.

### [18] NAV1 INDICATOR LAMP

This lights up in yellow if the NAV1 unit is activated by you inputting a frequency and the station involved is received.

### [17] BEARING V1 YELLOW (RADIAL)

This shows the magnetic course to the NAV1 station as a yellow number. If an ILS is used, this represents the direction to the touchdown point at the beginning of the relevant runway.

### [20] POINTER TO TOUCHDOWN POINT, YELLOW

The yellow diamond shows the direction to the touchdown point in relation to the current heading it always runs along the outside of the circle.

### [16] DISTANCE V1, YELLOW

This shows the distance to the navigation device determined by the DME, normally the ILS. The figures in yellow are nautical miles.

### [1] SELECTED RADIAL

If a VOR is present the absolute value of the selected course towards or away from the radial beacon appears as a yellow number at the top left below CRS (preset course) and a yellow pointer which shows the direction relative to the current heading appears in the circle.

If the ILS is in use, the radial set automatically represents the landing direction relative to the current heading of your airplane. This is shown by a yellow double pointer [17] relative to your heading.

### [19] RUNWAY DOUBLE POINTER, YELLOW

The yellow double pointer indicating the runway shows the landing direction relative to your

current course. The yellow number [1] below the CRS, however, indicates the absolute direction for landing. This appears automatically when the navigation computer recognises the destination airport with its data on the basis of the ILS frequency.

### [2] ILS / OFF INDICATOR

The display 'OFF' in yellow on a red background tells you that you are not within radio range of the ILS. When the ILS signals are received correctly "ILS" appears here in red on a yellow background.

### [7] GLIDE PATH INDICATOR, RED

The red marker with the two horizontal lines at the left and right of the diamond is the glide path indicator. This moves only up and down on the vertical centre axis of the circle and shows your position in relation to the glide path. If the marker lies above the aircraft symbol you are flying too low. If the marker is below the symbol, your altitude is too high. For this reason you should try to keep the marker exactly on the aircraft symbol to maintain your optimum glide path.

### [8] LANDING COURSE GREEN (CENTRE LINE)

The green marker with the two vertical lines above and below the diamond is the landing course indicator (centre line) when the ILS system is in use. It moves only on the horizontal centre axis of the circle from left to right and shows your deviation from the landing course. You can correct your course by flying "TO THE MARKER" until it has become centred.

### [4] OUTER AND MIDDLE MARKER

The optical displays for the outer and middle markers appear in this panel as white letters on a red background for the middle marker and white letters on a blue background for the outer marker.

### [13] EVALUATION POINTS

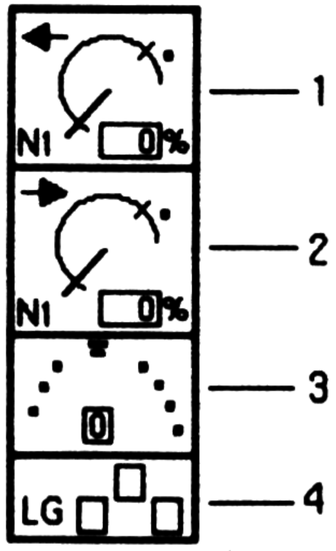
Evaluation points from O to 65 appear in red on a black background. The points 66 to 100 which must be achieved for a successful result appear in yellow against a black background.

### [14] EVALUATION INDICATOR

An orange coloured panel means that evaluation of your approach has not yet started. By comparison, a blue panel means that you are in the positive evaluation range.

# ENGINES, FLAPS, UNDERCARRIAGE

5




1 = N1 Left Engine
2 = N1 Right Engine
3 = Slats and Flaps
4 = Landing Gear

**[1] N1 LEFT ENGINE**
**[1] N1 RIGHT ENGINE**

The power of the two engines is displayed as a percentage of their maximum speed in the two top panels to the far right, once as a graphic display with a blue pointer and below that as a numeric value.

**[3] SLATS AND FLAPS**

This shows the position of the slats and flaps in the settings O – 4.

**[4] LANDING GEAR**

The monitor lamps show the condition of the nose wheel and main landing gear. Green means that the landing gear has been extended and locked. Red means the landing gear is moving (in or out) and orange indicates that the landing gear has been retracted.

# KEYBOARD ASSIGNMENTS

## CONTROL KEYS

As you became familiar with all the cockpit instruments in the previous chapter we should now look at the key assignments which are important for controlling your airplane. The Appendix contains a complete list.

## CURSOR KEYS

| | |
|---|---|
| [Cursor Up] | Set rudder to 'Climb' |
| [Cursor Down] | Set rudder to 'Descend' |

With SEEK/HOLD HEADING active:

| AMIGA | Function |
|---|---|
| [Cursor Left] | Reduce preset course |
| [Cursor Right] | Increase preset course |

## MAIN KEYBOARD

| AMIGA | Function |
|---|---|
| [E] | Switch EFCS on/off |
| [J] | Select mouse or joystick |
| [Shift Left] | Reduce preset course NAV1 if VOR |
| [Z] | Increase preset course NAV1 if VOR |
| [Alt Left] | Reduce preset course NAV2 if VOR |
| [Amiga Left] | Increase preset course NAV2 if VOR |
| [Backspace] | Activate auto ILS intercept final |
| [Return] | Activate auto ILS full pattern |
| [Spacebar] | Braking in the air and on the ground |

## FUNCTION KEYS

| | |
|---|---|
| [F1] | Retract slats and flaps |
| [F2 | ]Slats and flaps in position 1 |
| [F3] | Slats and flaps in position 2 |
| [F4] | Slats and flaps in position 3 |
| [F5] | Fully extend slats and flaps |

If SEEK/HOLD HEADING is active you reduce or increase the selected course with the [Cursor Left] and [Cursor Right] keys respectively. The course is shown under SEL [5] above the artificial horizon. SEL [5] above the artificial horizon.

If SEEK/HOLD HEADING is not active you control your airplane by moving the mouse or joystick to the left or right to adjust the rudder. You can follow its position with the pointer [12] below the artificial horizon.

The [Cursor Up] and [Cursor Down] keys are used for trimming. They can also be used for steering. Their actual use will become clear in conjunction with the Gravis Mousestick on the AMIGA or the analog joystick on MS-DOS computers:

Trimming sets a certain climbing or descending value. However, the stick remains in the centre position, i.e. you do not need to constantly pull or push it. This is less of interest if you are using a mouse or digital joystick.

Moving the mouse or joystick forwards or backwards adjusts the elevator and you can follow its movement on the pointer [9] to the right of the artificial horizon.

You switch the EFCS on or off with [E] on the main keyboard. The monitor lamp E [2] above the artificial horizon indicates whether the EFCS is active.

With [J] you select the unit you wish to control. The monitor lamp C [4] (Control) above the artificial horizon shows the unit selected, in the following colours:

- Black Mouse
- Yellow Gravis Mousestick
- Blue Joystick
- White PC-type analogue Joystick (see Annex)

The course selected for NAV1 is reduced with the keys [left ALT] and is increased with [left AMIGA].

You activate auto ILS Intercept Final with the [Backspace] key on AMIGA/ATARI ST computers or [A] key on MS-DOS computers.

The [Return] key activates auto ILS Full Pattern.

With the [Spacebar] you brake your airplane on the ground with the wheels and in the air by using the air brakes. A red bar to the left of the artificial horizon appears to indicate that you are braking.

The function keys [F1] to [F5] control the settings of the slats and landing flaps which are required for take-off and landing.

## THE ENGINE KEYS

### *Amiga 600*

*The Amiga 600 does not have a numeric keypad. In the keyboard layout shown in the Appendix therefore the keys which have the same function as the numeric keypad on other AMIGA computers are shown with a black outline. On all Amiga computers, even those which have a numeric keypad, you can use the keys enclosed by wavy brackets in the following list. In the description we will only refer to the standard keyboard with the numeric keypad. Users of the Amiga 600 should please refer to the following table.*

# KEYBOARD ASSIGNMENTS

| All AMIGA except A600 | A600 | Function |
|---|---|---|
| [O] | {/} | Apply reverse thrust |
| [1] | {L} | Throttle back left engine |
| [2] | {;} | Throttle back both engines |
| [3] | {#} | Throttle back right engine |
| [4] | {P} | Start left engine |
| [5] | {[} | Activate auto pilot hold speed |
| [6] | {]} | Start right engine |
| [7] | {-} | Accelerate left engine |
| [8] | {=} | Accelerate both engines |
| [9] | {\} | Accelerate right engine |
| [-] | {Amiga Right} | Shut down left engine |
| [ENTER] | {Alt Right} | Shut down right engine |
| [.] | {Shift Right} | Shut off reverse thrust |
| [F9] | {F9} | Retract landing gear |
| [F10] | {F10} | Extend landing gear |

Most key assignments are self-explanatory.

The key [O] for reverse thrust can only be activated if both engines are first throttled down to 17% idling speed after landing.

The key [5] automatically holds the current speed and adjusts the engine power if you climb, descend or extend the landing gear and flaps.

With keys [2] and [8] you disable the hold speed function and if necessary you must therefore reactivate it with [5] again when you have reached the new speed required.

## NAVIGATION KEYS

| AMIGA | Function |
|---|---|
| [F6] | Look to left out of cockpit |
| [F7] | Look ahead |
| [F8] | Look to right out of cockpit |
| [Del] | Resets auto pilot |
| [Help] | Activate auto pilot Seek/Hold Heading |
| [Q] | Page through text and delete |
| [Ctrl] | Do not show towns, rivers or seas |
| [Shift Left] | Show towns, rivers and seas |
| [F] | Accelerate movement by factor 2 |
| [S] | Zoom out on cockpit view |
| [D] | Zoom in on cockpit view |
| [H] | Pause on/off |
| [N] | Switch between day/night, training mode only |
| [Esc] | Program reset |
| | Switch between chip sound/digi sound |

You switch off all the active auto pilot functions except EFCS with the [Del] key.

The [Help] key activates the automatic SEEK/HOLD HEADING facility which finds and holds your set course. When activated it turns the aircraft onto the course you selected and holds it on that heading.

With [Q] you can call up messages which show your landing instructions and the weather conditions. The window goes blank after the last message. Naturally you can keep one of the messages visible so that, for example, you can always look at your landing instructions.

The [Ctrl] key as well as [Shift Left] switch the detailed display of the landscape on or off respectively. The program will speed up noticeably if rivers, towns and oceans are not displayed. The image display rate will rise. If you re-activate such details the program will run at normal speed again.

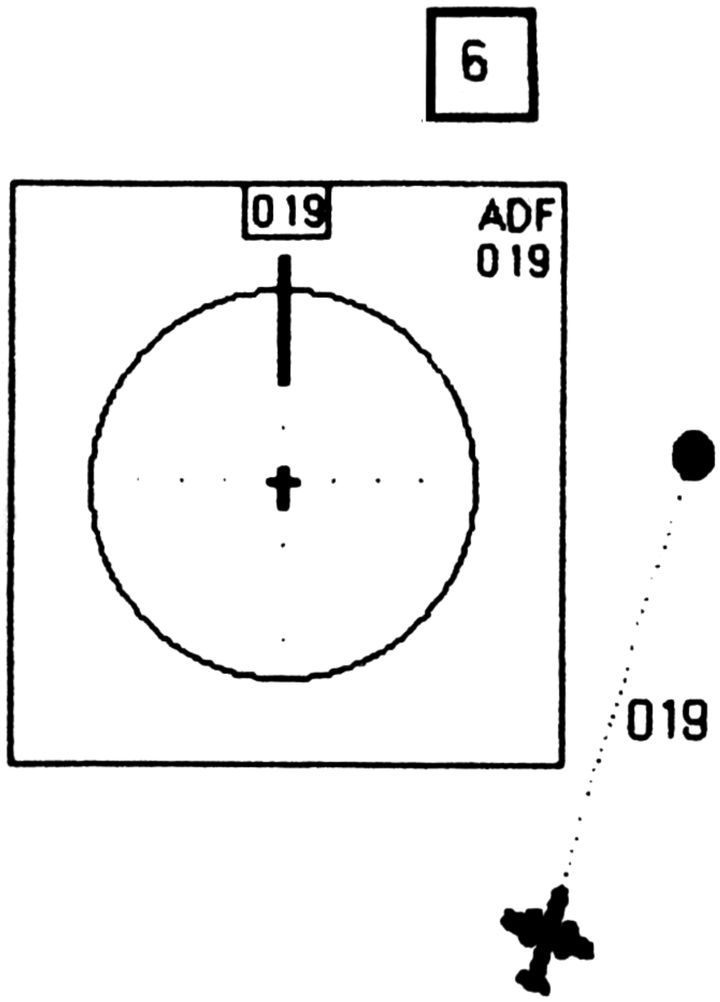
The program operates in real time, i.e. one minute in the program lasts for 60 real seconds. The [F] key speeds up this time by a factor of 2, so that one minute in the program only actually lasts 30 real seconds. This is shown most clearly by the seconds display on the on-board clock. Switch the acceleration feature off for your approach and landing, so that you land in real time.

Switching between day and night with the [N] key is only available in the training mode.

# RADIO NAVIGATION / ADF NAVIGATION

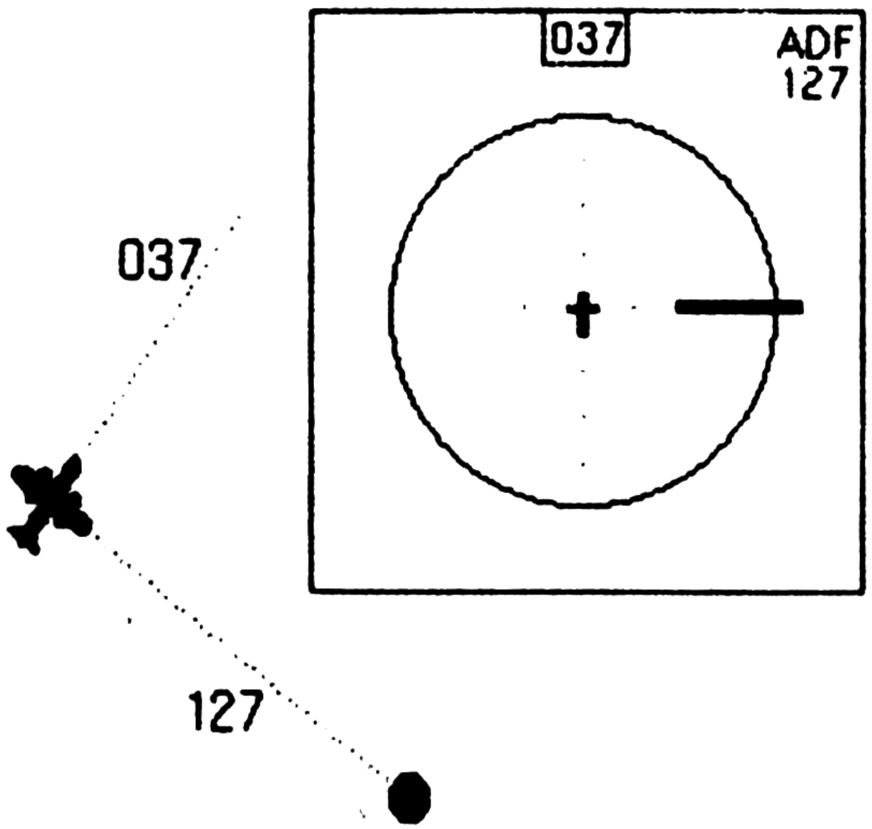
Navigation with the aid of a non-directional beacon, i.e. an omni-directional radio beacon NDB on the ground, when combined with the auto direction finder ADF on board the aircraft is technically very different from VOR navigation. For the pilot, however, this difference is of almost no importance. Both facilities indicate the direction to the selected radio beacon by means of an arrow.

## Determining your position



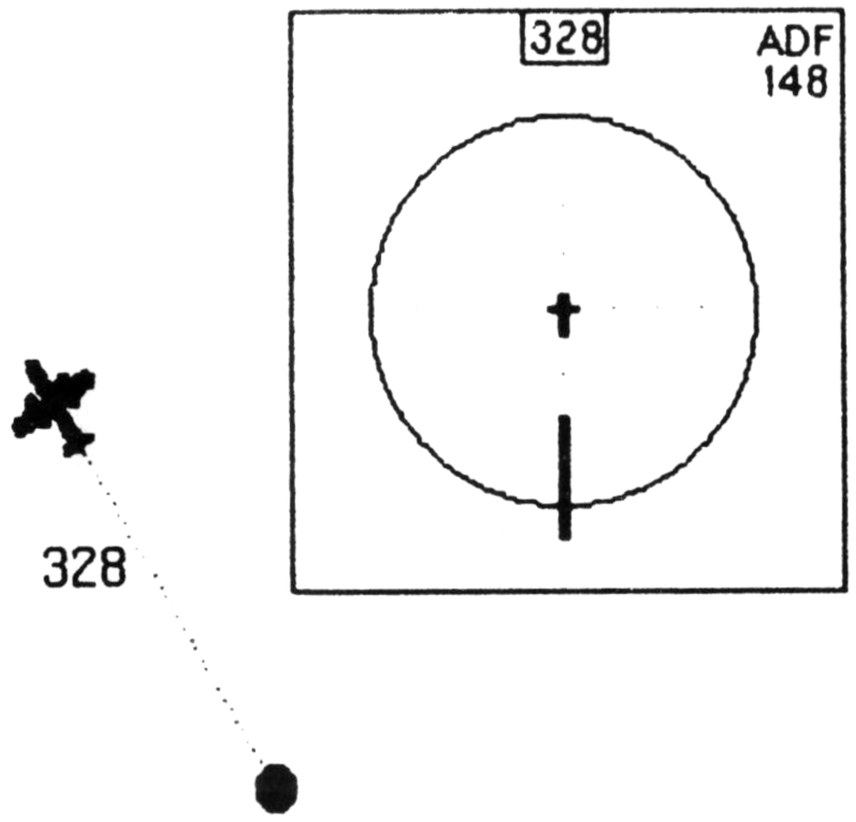

The NDB station is directly ahead of you. Its heading is 019, the ADF therefore indicates 019 and the ADF arrow points straight up.

7



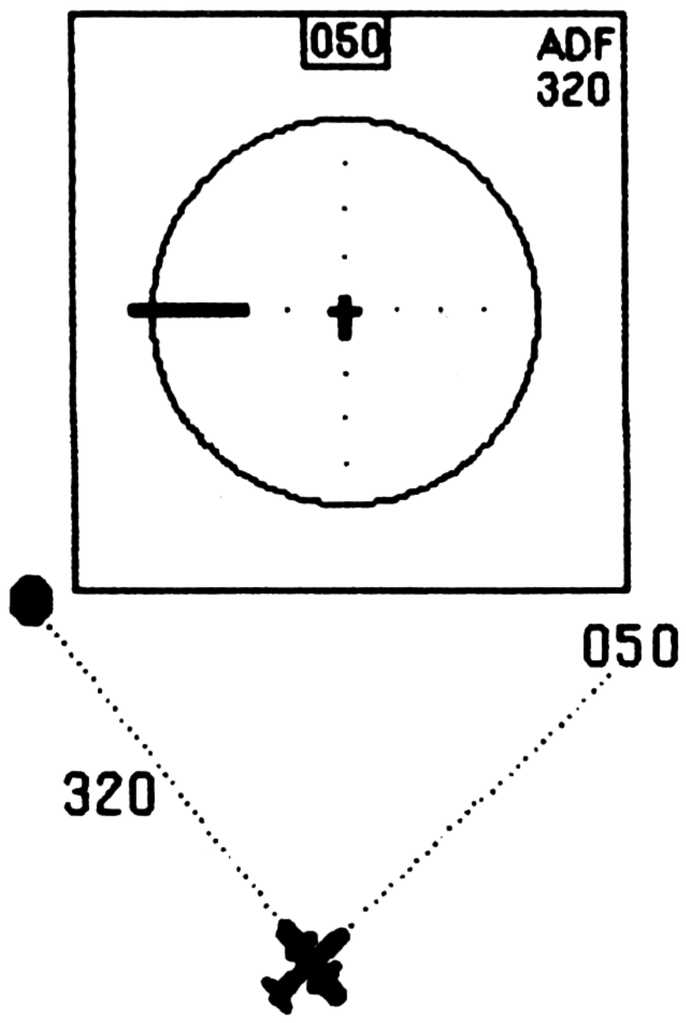

The NDB station is exactly to the right of you, i.e. abeam to the right. Your course is 037, the ADF arrow indicates that you are exactly to the left of the NDB station, at right angles to it. Your course to the NDB is therefore 037 + 090 = 127 degrees.

8




The NDB station is directly behind you, i.e. right astern. Your heading is 328 and the ADF arrow is pointing straight down. The direction to the NDB, based on north, is therefore 328 – 180 = 148 degrees.

9

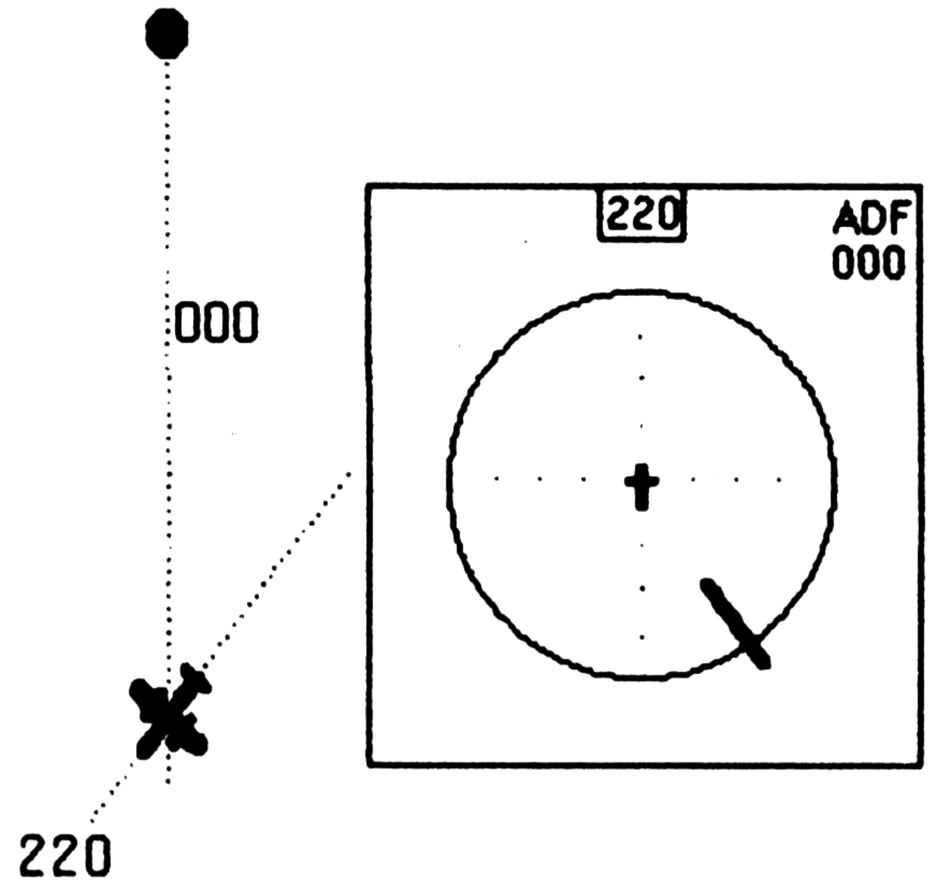



The NDB station is exactly to your left, abeam to the left. You are flying on a heading of 050. The ADF arrow is pointing to the left. The NDB station is exactly at right angles to your left. The heading is therefore 050 + (–090) = –040 = 320 degrees to the NDB.

The ADF arrow gives you an indication of where the radio beacon is located. The number above and to the right shows your current heading. This makes it much easier for you to determine your position when working with the approach map. All the headings shown always represent the courses to the NDB.

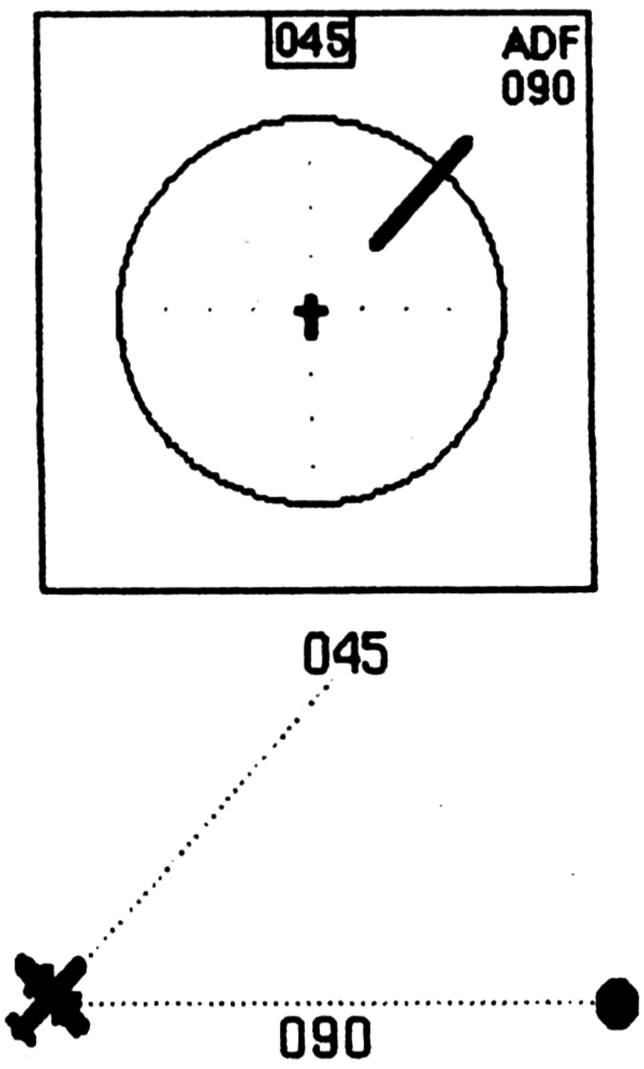
Irrespective of your momentary course the numeric ADF display at the top right shows four values for the exact position in relation to the NDB. It is therefore unnecessary to guess a radial:

10



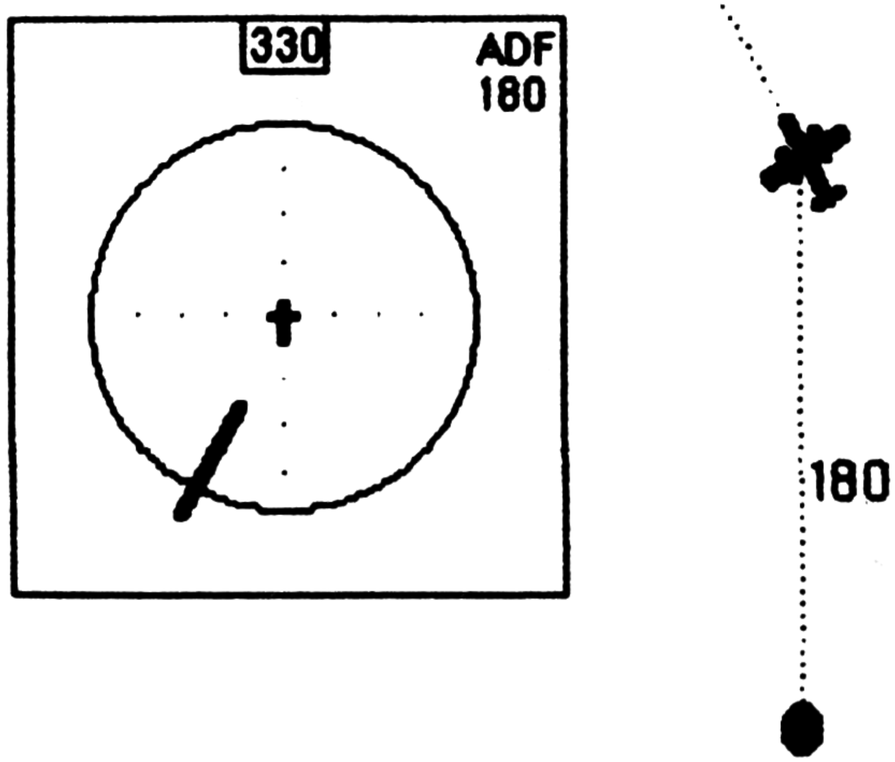

If the display shows 'OOO', you are exactly south of the NDB.

11



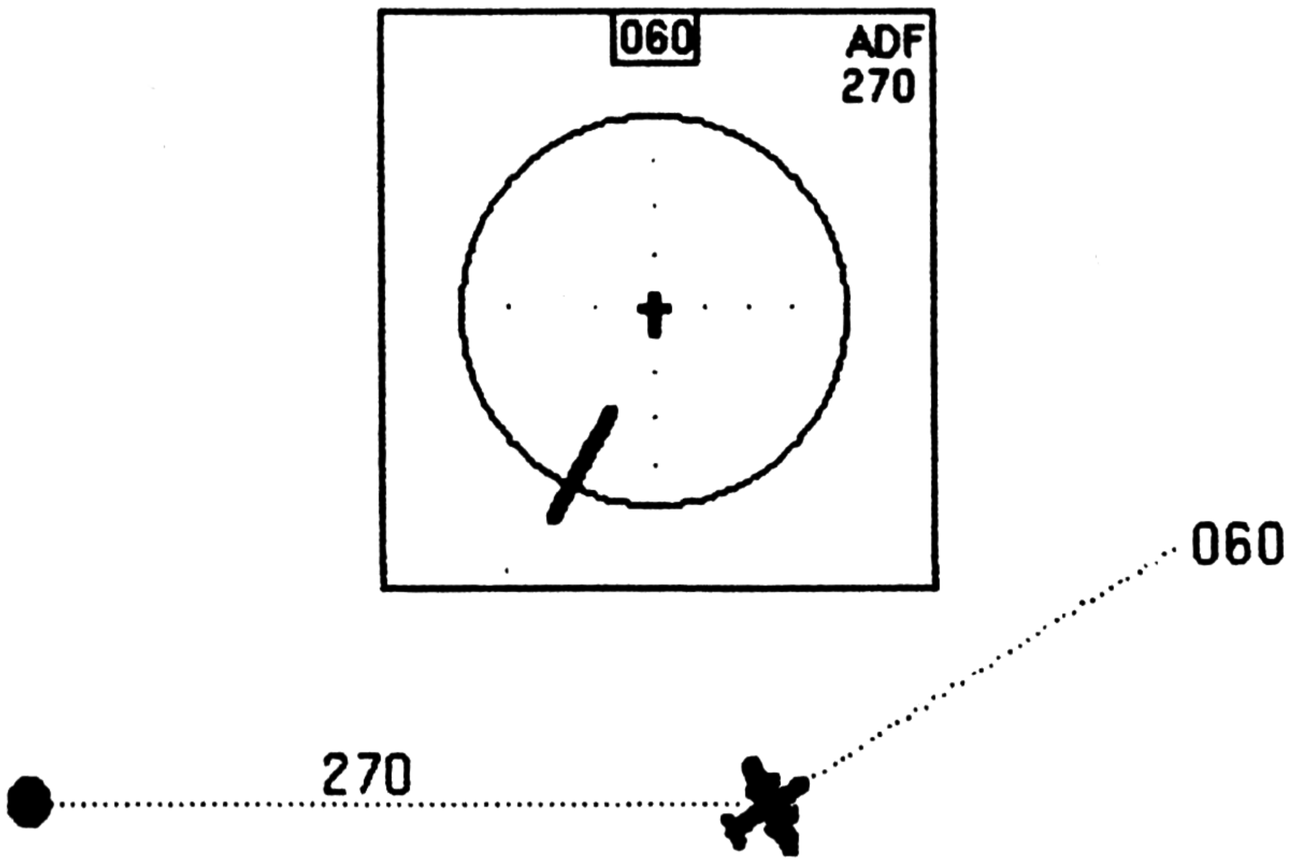

A value of '090' on the display means you are exactly west of the NDB.

12




A value of '180' on the display means you are exactly north of the NDB.

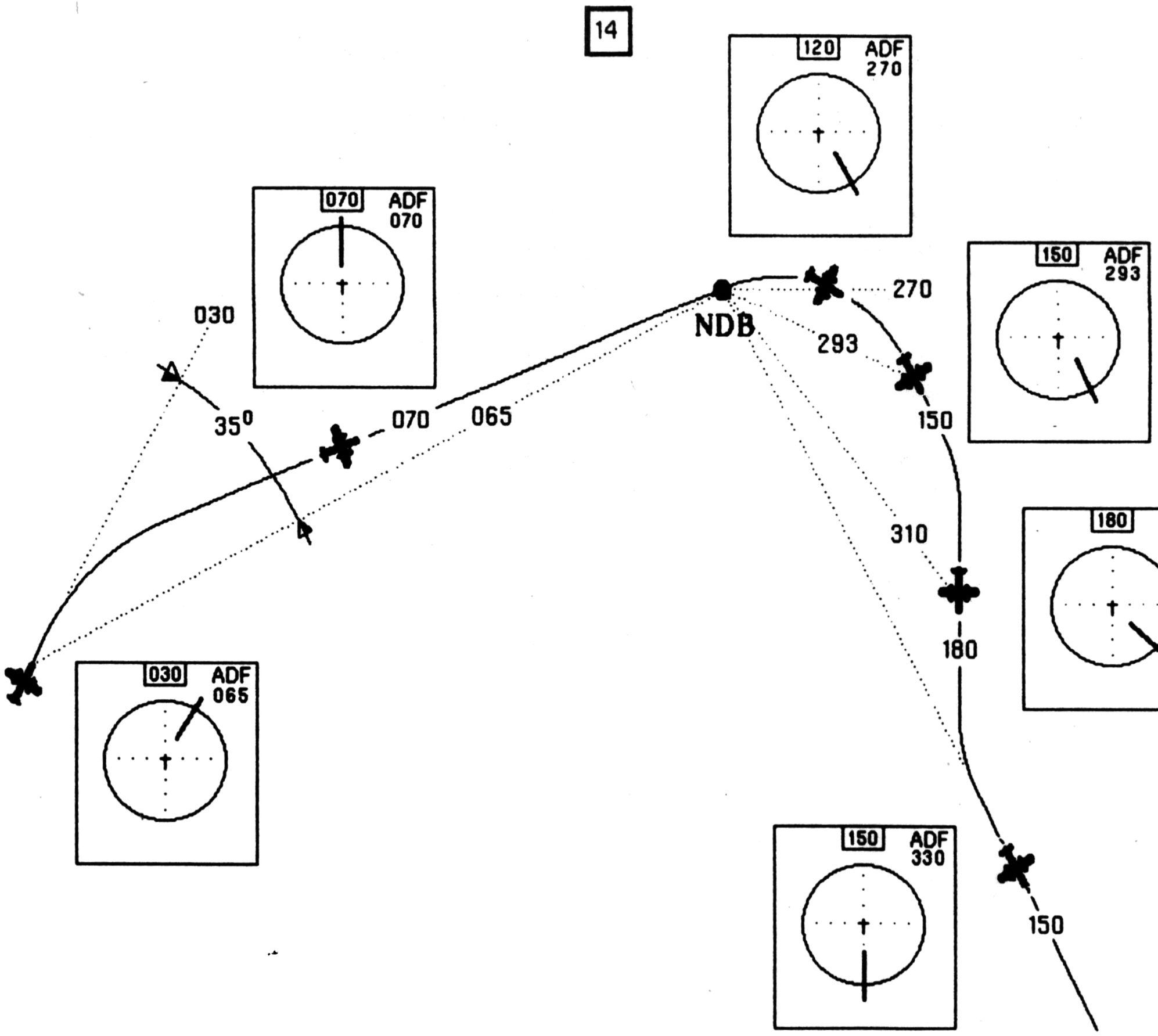
13




And the value '270' means you are exactly east of the NDB.

## Flying over an NDB

To determine your precise location you should fly directly over an NDB in your vicinity once you have determined on the map your course from the NDB to the destination required. Fig. 14 shows what you must do.


14
120
ADF
270
070
ADF
070
030
NDB
270
293
150
ADF
293
35°
070
065
150
310
180
ADF
310
030
ADF
065
150
ADF
330
150

Your direction is 030 and the on-board computer fixes a course, the heading, from 65 degrees to the NDB: 30 + 35 degrees. On the map you determine a departure course from the NDB to your destination airport of 150 degrees.

Turn to the right to the NDB until the direction arrow points straight up and your course coincides with the heading of the NDB as shown, in our example 070.

Hold this course until beacon swing occurs to indicate that you have flown directly over the NDB station. Now turn to the approach heading of 150 as determined. You are now flying to the left of the heading to the destination airport, parallel to it. In our example you are just to the right of the NDB on a course of 120. It therefore shows 270 because at this moment you are exactly east of the NDB and the arrow indicates that the NDB is to the right behind you.

Now turn through 30 degrees towards the heading 150 onto a course of 180. The ADF display will be similar to that shown in the diagram. Then turn onto a heading of 150 degrees as soon as the display shows 330. This heading will bring you straight to your destination.

# VOR NAVIGATION

## Basics

Very high frequency omnidirectional range stations are VHF radio beacons which continuously transmit a non-directional synchronisation signal followed by a rotating direction signal. The NAV receivers decode these signals and calculate which radials transmitted by VOR you are located on.

The radials point away from the VOR, just like the 360 spokes in a wheel.

The NAV2 instruments show you on which radial of a certain VOR your aircraft is currently located. With this information you can fly towards or away from the VOR involved.

You should note the following:

NAV2 indicators only tell you the radial you are on at the moment. They do not give you any information about your course.

If you hold down the adjustment keys the green marker will move twice to the middle, once with the 'TO' display and once with the 'FROM' display. If the marker is exactly in the centre and the 'TO' display shows blue letters on a yellow background you can see at the top the course which would bring you straight to the VOR.

If the 'FROM' display shows blue letters on a yellow background this is the course you would take to fly away from the VOR when it is precisely behind you.

If you are flying towards or away from the VOR the marker will move to the right of the centre if you are to the left of your correct course. To adjust your course, turn to the right and 'fly towards the marker'.

Imagine the centre of the instrument is your location and the marker is the position of the radial. If it is to your right you must fly to the right to return to it, and vice versa.

If the marker is in the centre, with 'TO' you are flying towards a VOR and with 'FROM' you are flying away from it. But if you fly away from it with 'TO' on the display, the needle is reversed, i.e. if you move to the left of your course it would not move away to the right but would also move the left.

This also applies if you use the 'FROM' display for an approach. In such cases you must therefore fly 'away from the marker' in order to reach the course you require.

But now to your practical work with the VOR and its radials.

All the following examples are intended only as explanations and need not necessarily be carried out.

# Determining your position

## A VOR/DME is available

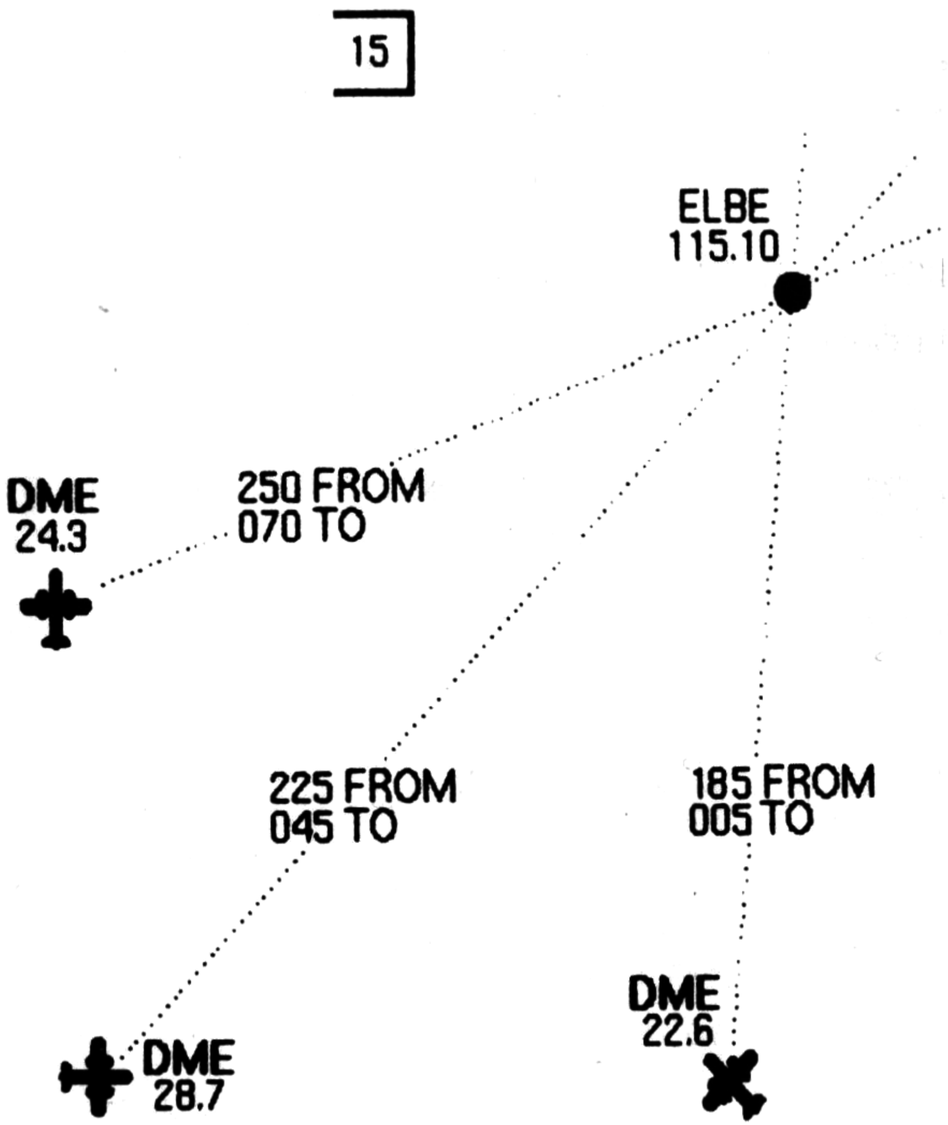
There are several ways of determining your own position high up in the clouds with the aid of one or more VOR's. There is also one rather unconventional method which only we are able to use: The [H] key which stops the program but still lets you continue working.

You see, by the time you have read, compared and entered all the information required, you would have flown several tens of miles. So please make use of the [H] key if you do not want to work under pressure. Once you have practised these procedures several times you will no longer need this facility.

The distance measuring equipment DME gives you the distance to the VOR in nautical miles. This uses the time taken for the signal to travel from the aircraft to the ground station and the reply to return from the ground station to the aircraft to measure the distance accordingly.

The DME frequency (in a higher frequency band) forms a pair with the respective VOR frequency. It is automatically selected by setting the VOR frequency

You entered the frequency 115.10 for NAV2. In the APPROACH TRAINER NAV1 is automatically set to the ILS frequency.



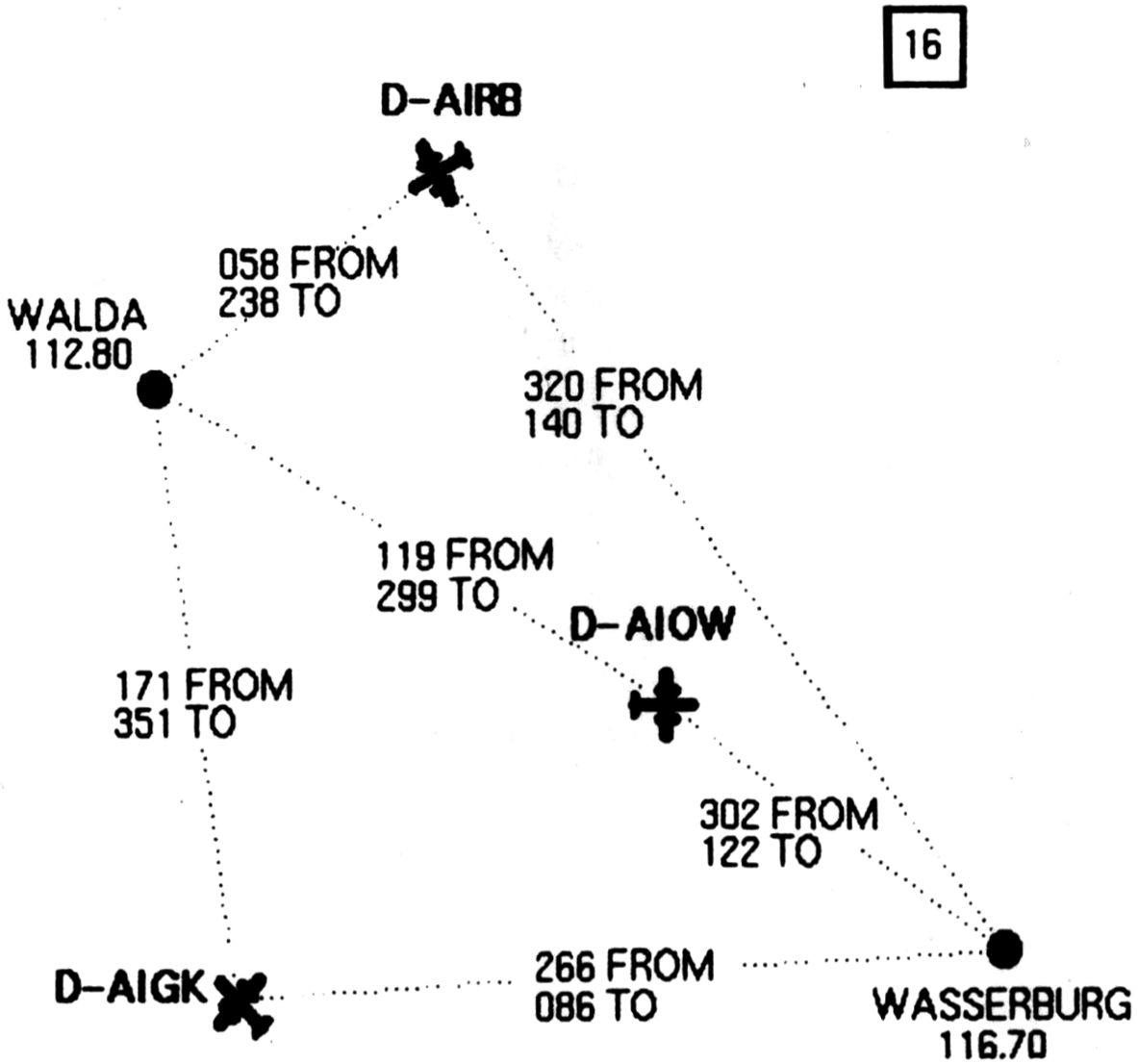

Now set the marker in the centre with one of the appropriate keys [Shift Left] or [Z] and read the number for the heading.

On the display at the top left you would either see '250 FROM' or '070 TO' and 24.3 NM to the VOR Elbe.

Now enter this heading with a protractor on the map and the distance of 24.3 NM then determines your location. This also applies to the other two instruments.

## Only two VOR's without DME are available

This is rather more difficult, but also much more interesting!



Let us assume you are totally lost in the area between Stuttgart and Munich and are receiving on NAV1 whose ILS frequency you have overwritten for this purpose the station VOR Walda at 112.80 and on NAV2 the station VOR Wasserburg at 116.70. If you are flying the D-AIRB and are on the correct course you should not be worried about the small diversion over Walda and will turn to 238 TO. When you see the beacon swing you are exactly over VOR Walda.

You can then determine your new course to your destination.

Let us give you the second possibility for D-AIGK:

You centre the NAV1 marker and read 171 FROM. Enter the frequency of NAV2 in the line of N1 and centre the NAV2 marker. This gives you the value 266 FROM. A glance at the map shows you the direction you must enter the radial in to obtain an intersection point which then determines your momentary location for D-AIGK. From there it is easy for you to find your route.

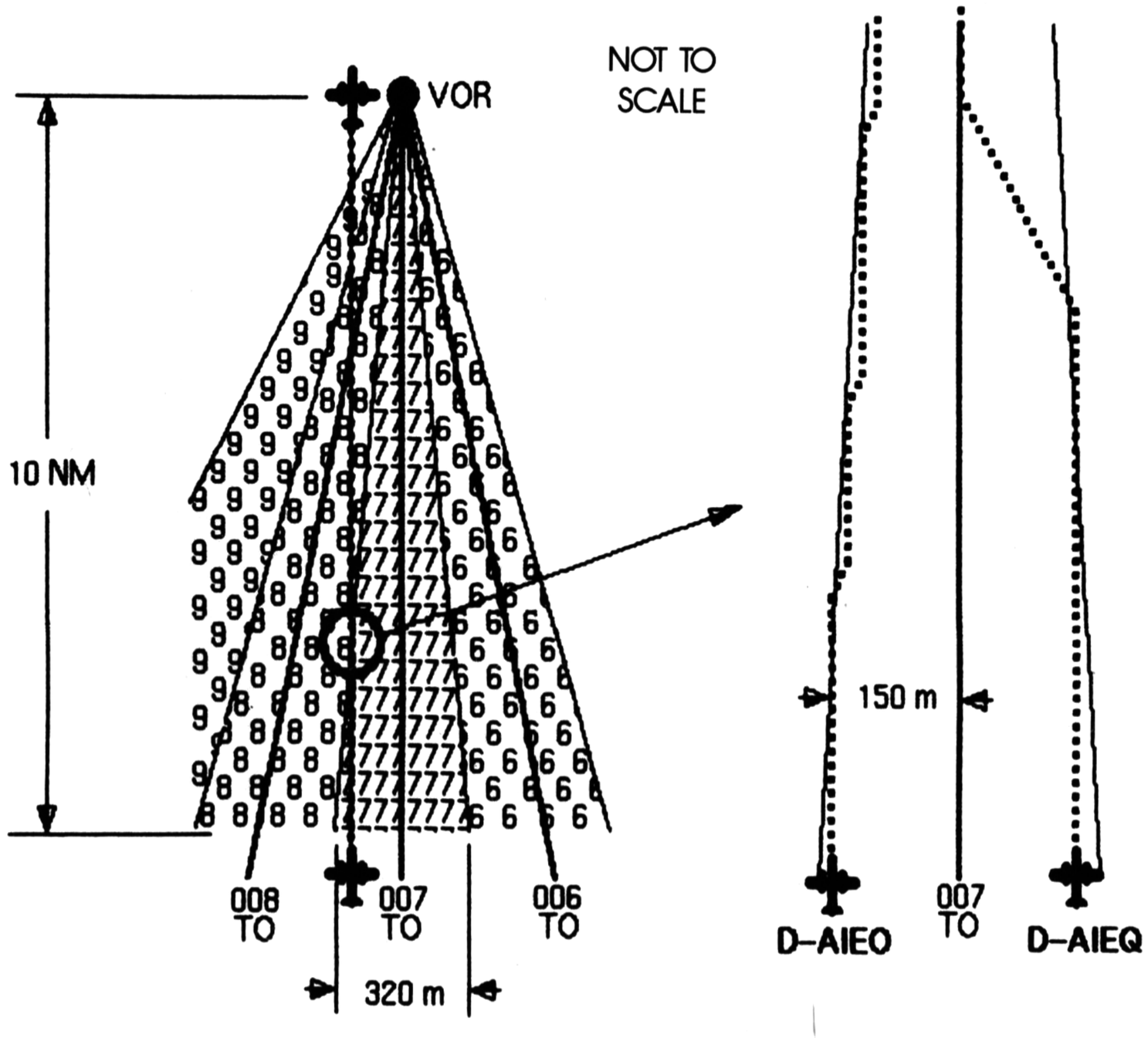
The position of D-AIOW shows what happens if you are unlucky and end up almost exactly between two VOR's. The two headings determined do not produce any intersection point or a very inaccurate one. But at least you know that you are between these two VOR's.

You can then decide whether you want to fly over one of the VOR's or whether you should use the above method a few miles further on so that you can then determine your exact position.

## Flying towards a VOR

Fig. 17 shows what happens if despite the gyro compass and coinciding values on the NAV2 display the marker moves to the left or right a short time later without you having changed course.

17


VOR
10 NM
008
TO
007
TO
006
TO
320 m
NOT TO
SCALE
150 m
D-AIEO
007
TO
D-AIEQ

The sector limited by the two headings is an equilateral triangle whose top is located at the VOR. If you are successful in flying exactly along the heading, the marker will not move. But who on earth can do that? At a distance of 10 NM from the VOR the two radials are 320 m apart. With an offset of 150 m you are therefore still in the sector of the heading 007 TO. To illustrate this point, Fig. 17 is not to scale.

It is clearly apparent that with a course of 007 at the bottom edge of the screen you are still in sector 007 TO the VOR. In a few miles you will leave this sector and will fly into sector 008 TO. Soon after that you will reach sector 009 TO.

The point at which you leave sector 007 TO was marked by a cross and is shown on an enlarged scale at the right in Fig. 17.

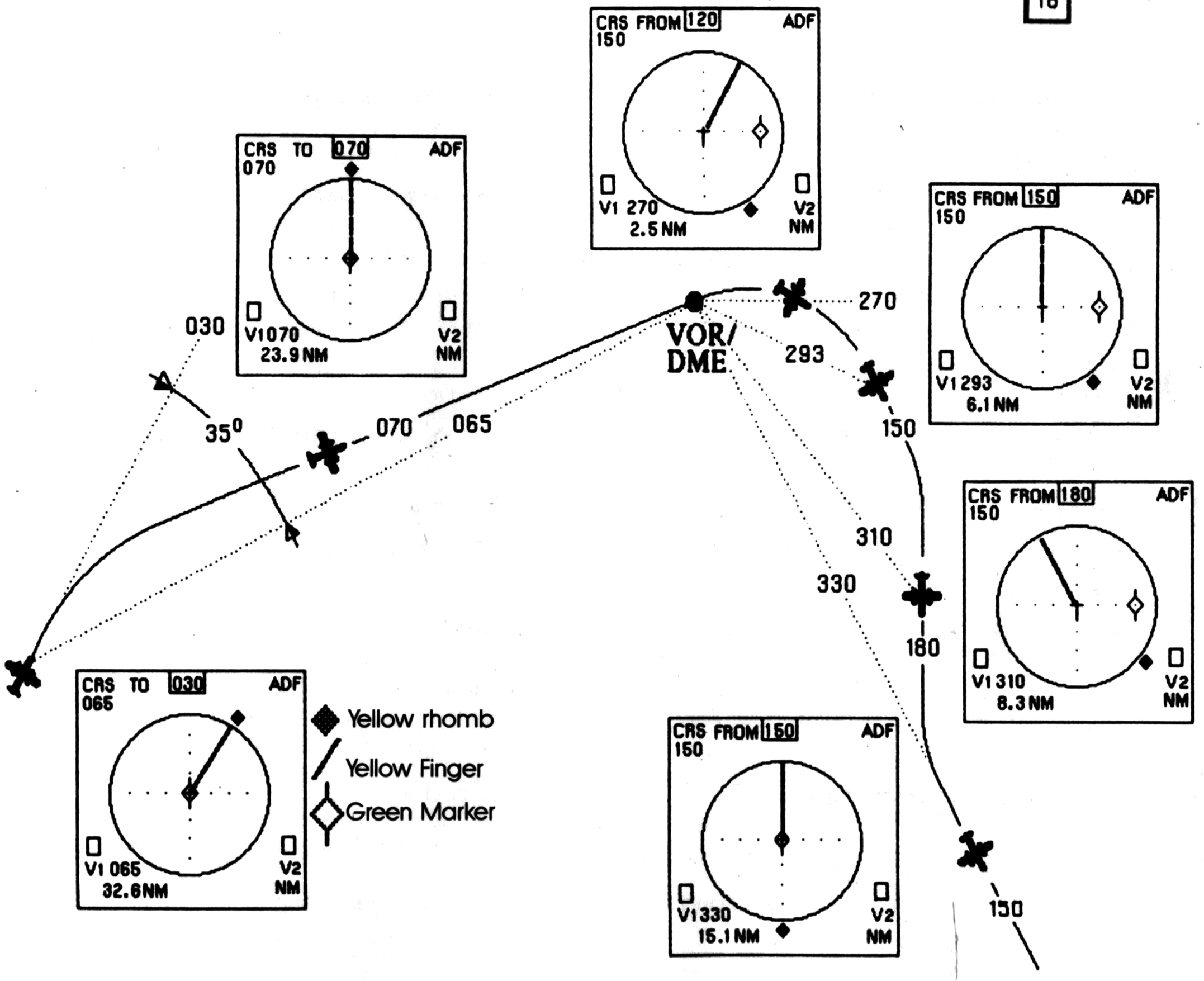
The aircraft D-AIEO is approaching the edge of sector 007 TO. The instant it flies over the separation line the marker on the NAV2 instrument will move to the right.

If you change course 'towards the marker' as soon as it moves, the marker will soon return to the centre. If you take up your old course immediately it will not take long for the marker to move to the right again. As shown in Fig. 17, you can use this method to move towards the heading line in several small steps.

You can reduce the adjustments made to your course if you retain your intersecting course for slightly longer and, as shown at the right-hand side of the screen, approach the radial in a smaller number of steps. It is up to you how long you wish to maintain this intersecting course, depending on your distance from the VOR and therefore your distance from the radials.

## Flying over a VOR/DME

When flying over an NDB you became familiar with the ADF displays. Now look at the same situation in Fig. 18 for a VOR/DME.


CRS FROM 120 ADF
150
V1 270
2.5 NM
V2
NM
CRS TO 070 ADF
070
V1 070
23.9 NM
V2
NM
CRS FROM 150 ADF
150
V1 293
6.1 NM
V2
NM
030
35°
070
065
VOR/
DME
270
293
150
310
330
180
150
CRS FROM 180 ADF
150
V1 310
8.3 NM
V2
NM
CRS TO 030 ADF
065
V1 065
32.6 NM
V2
NM
CRS FROM 150 ADF
150
V1 330
15.1 NM
V2
NM
Yellow rhomb
Yellow Finger
Green Marker

After entering a VOR frequency and making radio contact the following displays appear on the instrument:

– Yellow diamond
This moves just outside the circle, around the entire circumference, and shows the direction to the VOR in relation to the heading of your airplane.

– Yellow pointer along the radius of the circle
This shows the direction of the radial set under NAV2 in relation to the heading of your A320. The selected radial also appears on the numeric display at the top left under CRS.

– Green marker
This shows the difference between your course and the selected radial.

TO (blue on a yellow background) tells you that you are on a radial which leads to the VOR/DME.

FROM (blue on a yellow background) means that the radial leads away from the VOR/DME.

V2 at the bottom right indicates the radial of the VOR/DME you have just flown over.

NM at the bottom right gives you the distance to the VOR/DME in nautical miles.

We assume again that you are approaching the VOR/DME on a course of 030 and when you reach the radial 065 this value is shown on the CRS display.

The yellow diamond shows you that the VOR/DME is to the right, ahead of you. You can determine the angle from radial 065 minus your course 030 = 35 degrees. V2 shows 065 and NM 32.6 nautical miles.

The yellow pointer points in the same direction because you had selected radial 065 and you are located directly on this radial flying towards the VOR/DME.

The green marker is at the centre. You are exactly on your course 030.

When you have set a new radial 070 and have reached that radial after a long turn to the right

the yellow diamond and the yellow pointer will both be pointing straight up. The green marker is at the centre again. You are flying inbound to the VOR/DME, i.e. directly towards it.

You found that your destination airport lies on the radial 330 FROM the VOR/DME = 150 TO. After flying over the VOR/DME, which you notice through the beacon swing, you select your new course 150 and fly in a turn to the right.

Note the V2 display. As soon as it shows radial 270 you are exactly east of the VOR/DME. Assuming that your course is 120 at the moment, the yellow pointer shows 30 degrees to the right ahead of you (150 – 120 = 30).

The green marker is at the right-hand edge and indicates that the selected radial is to your right.

The FROM display indicates that you on a radial outbound from the VOR/DME, i.e. are travelling away from the VOR/DME. The yellow diamond shows the position of the VOR/DME behind you to the right.

Approximately at radial 293 the yellow pointer will point straight up. You have reached your course 150. The position of the green marker has not changed and the yellow diamond has only moved slightly.

To fly along the radial 150 TO you must now change course through 30 degrees to 180 degrees.

The yellow pointer moves to the left and shows the direction of the selected radial in relation to the heading of your airplane.

As soon as the green marker starts to move to the centre you start a left-hand turn and intersect with the radial 150 TO until the green marker reaches the centre. The yellow pointer is straight up. The yellow diamond shows that the VOR/DME is located exactly behind you.

The further procedures necessary up to the landing are described in the sections 'The ILS Instrument Landing System' and 'The EFCS Electronic Flight Control System".

# THE INSTRUMENT LANDING SYSTEM ILS

You have familiarised yourself with the NDB and VOR/DME radio beacons for long distance navigation. The ILS instrument landing system was introduced to enable you to make an approach and a safe landing even in very bad weather. It is used exclusively to control the horizontal and vertical position of a vehicle in its final approach to the landing.

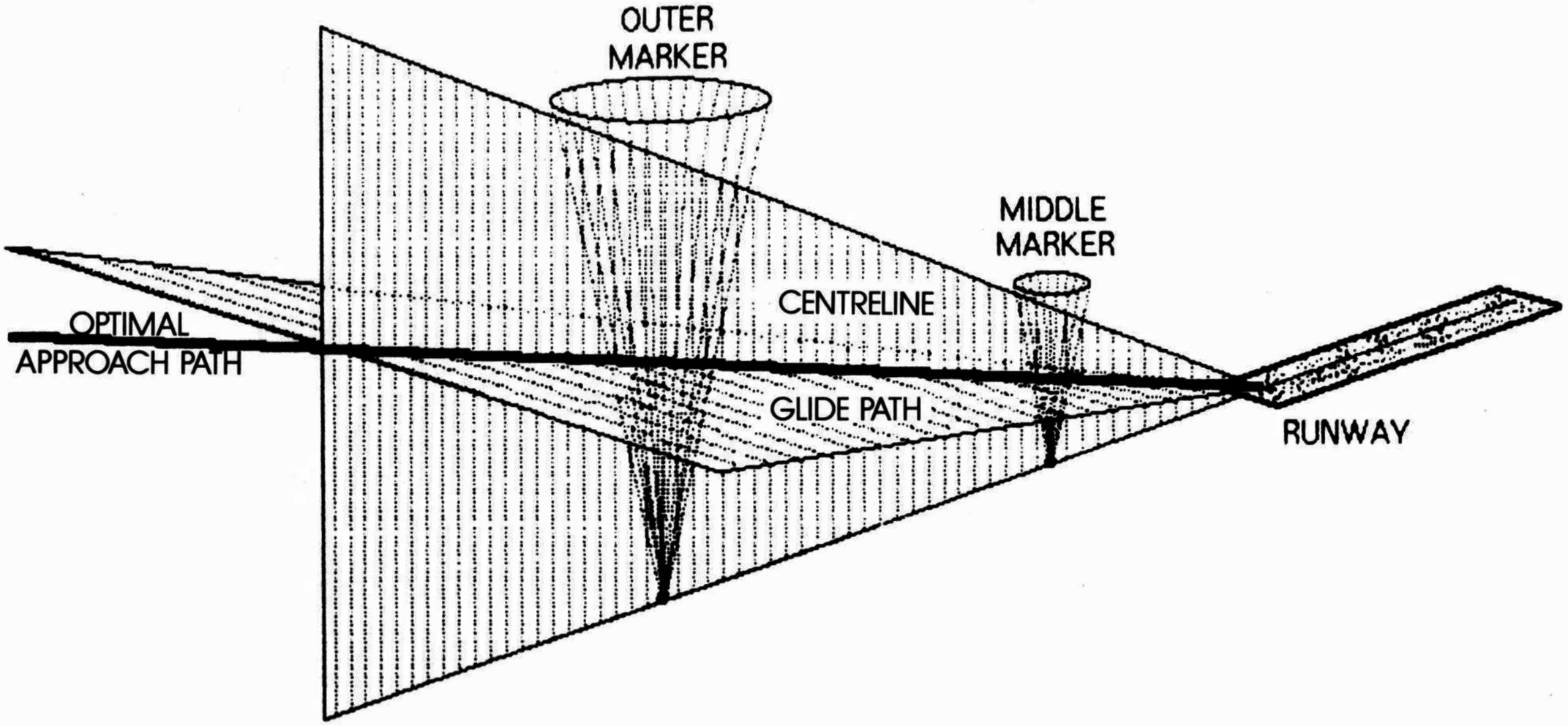
The system consists of:

Localiser transmitter

Glide path transmitter

Marker beacons

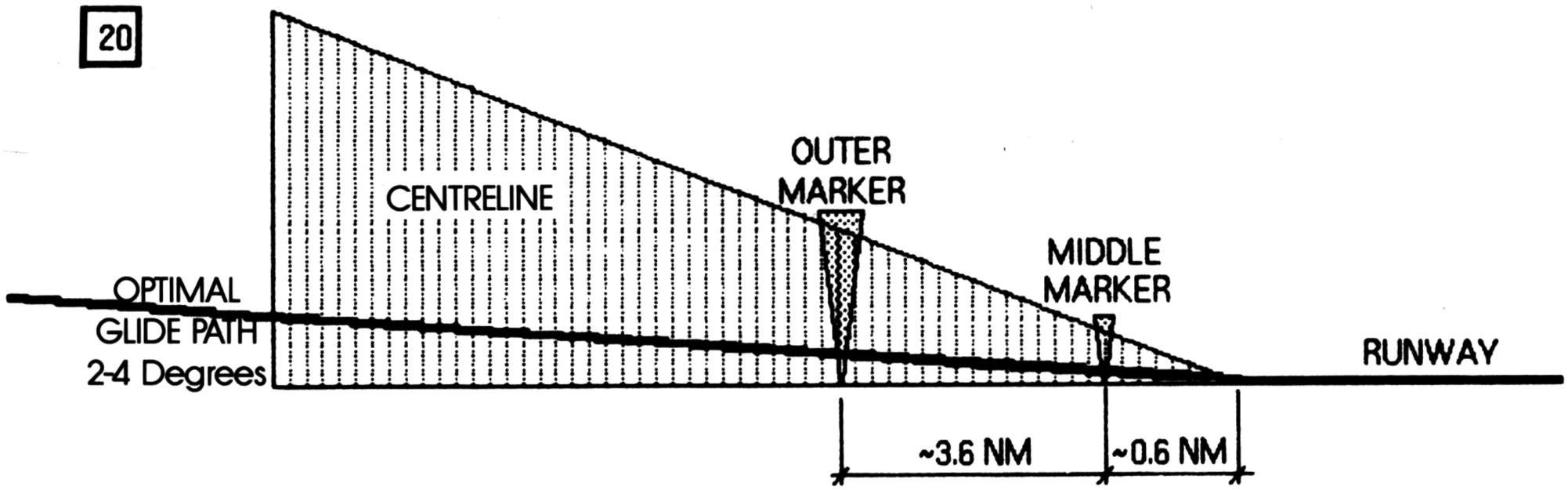
19


OUTER MARKER
MIDDLE MARKER
CENTRELINE
OPTIMAL APPROACH PATH
GLIDE PATH
RUNWAY

# THE ILS

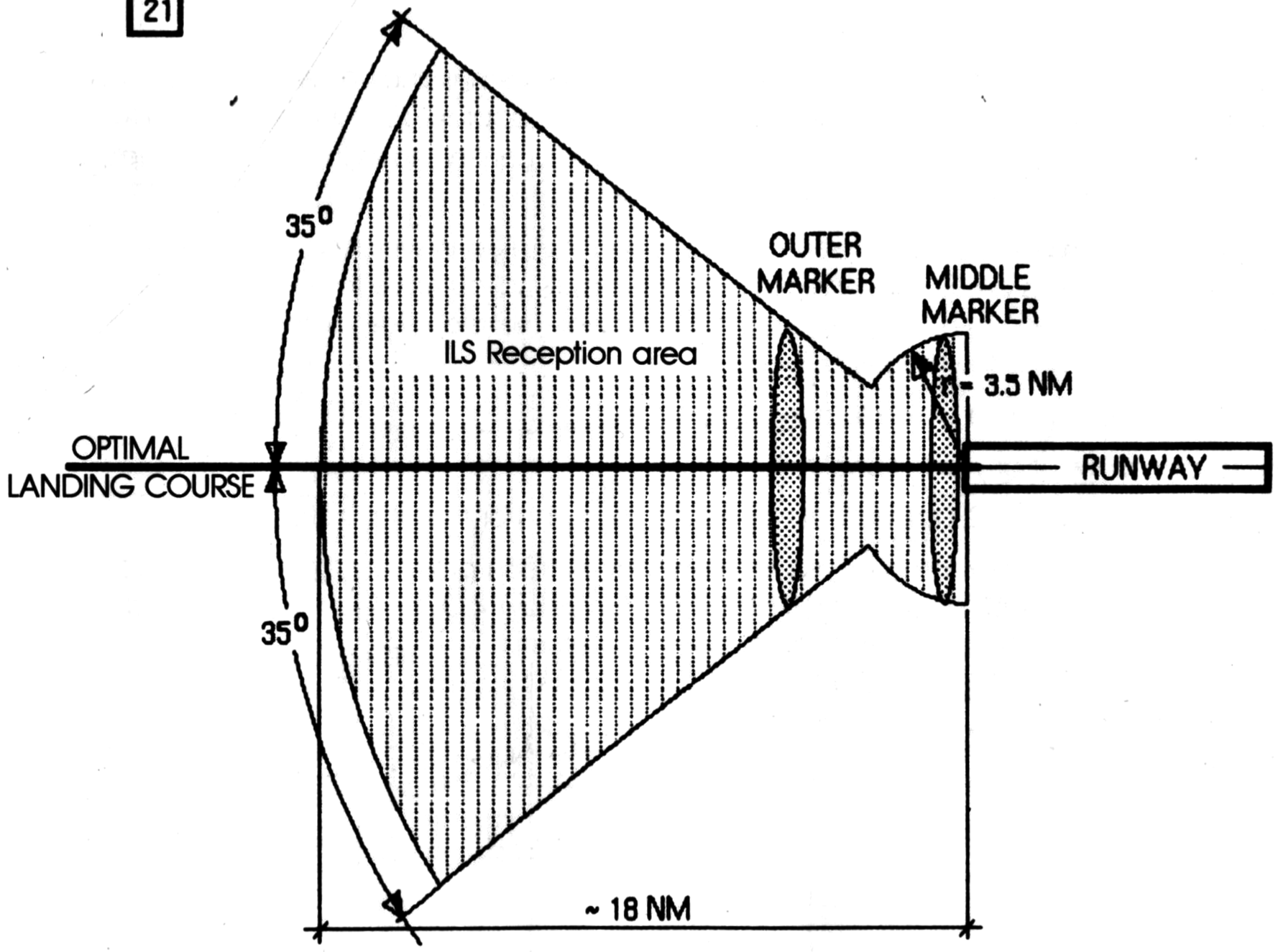
The localiser transmitter guides the aircraft in the horizontal direction. Any deviation from the aircraft's course is shown by the green marker which moves from left to right along the horizontal centre line on the instrument. You always correct your course by flying 'to the marker' until it reaches its centre position again.

The glide path transmitter guides the aircraft in the vertical direction. Any deviation from your correct glide path is indicated by the red marker which moves up or down on the vertical centre line of the instrument. Similarly, you correct your course by flying 'to the marker'. When it reaches the centre you are located on the correct glide path of approx. 3 degrees.




The radio beacons are located on the approach ground line, the extended centre line. The outer marker is located approx. 4 nautical miles ahead of the runway and is indicated by an acoustic and optical signal 'OM' in white on a blue background. The middle marker is located O.6 nautical miles from your touchdown point and also has an acoustic and optical signal 'MM' in white on a red background.

21


35°
OUTER MARKER
MIDDLE MARKER
ILS Reception area
3.5 NM
OPTIMAL LANDING COURSE
RUNWAY
35°
~ 18 NM

# THE ILS

The area in which your aircraft can reliably receive the ILS System is shown by the shaded area in the diagram. This consists of a semicircle with a radius of approx. 3.5 nautical miles and two segments of 35 degrees each on each side of the extended centre line with a radius of approx. 18 nautical miles whose centre points lie at the touchdown point.

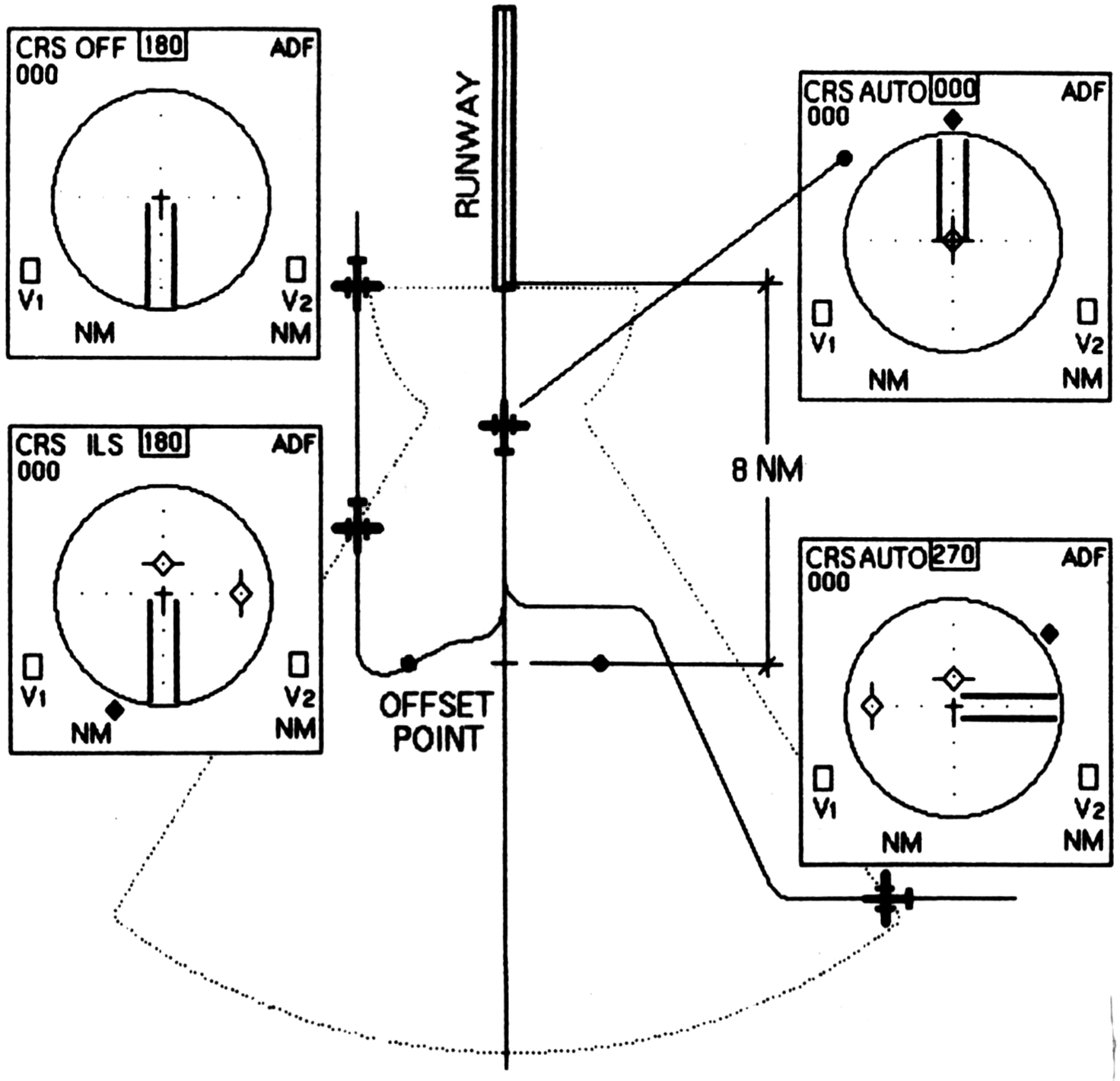
The TO/FROM/OFF display shows when you have reached the area in which you can receive the ILS signals. 'ILS' in red letters on a yellow background means that you have radio contact with the ILS. At the same time the green localiser transmitter marker, the red glide path marker and the yellow marker for the touchdown point appear.

The ILS gives you three ways in which to execute the landing:

- Manual landing without any additional help
- Landing using the EFCS, the SEEK/HOLD HEADING function and/or the HOLD SPEED function.
- FULL PATTERN as a fully automated approach from any position provided that you are located within radio range of the ILS at an appropriate altitude (below 4,000 feet). If these conditions are fulfilled you can initiate a FULL PATTERN by pressing [Return].

22

FULL PATTERN



The note 'AUTO' in yellow letters on a blue background replaces the ILS display. From this moment on, the automatic system controls the entire approach right through to touchdown, at which point it switches off.

You must then hold your airplane on the runway with the mouse or the joystick and brake the aircraft with the [Spacebar]. As in the full size airplane you can also assist braking at high speed by reversing the thrust of the engines (by pressing [0] on the numeric keypad). When you have braked your airplane to approx. 60 kts you should switch off reverse thrust again by pressing [.] on the numeric keypad. When the aircraft has reached a standstill your performance table appears with a graphic display of the approach, which you can step through with the [Esc] key.

The FULL PATTERN display gives you two possible approaches. The aircraft coming from the north on a heading of 180 degrees is still outside ILS radio range when level with the touchdown point. On the navigation instrument you see the yellow double pointers. They show that the aircraft is flying parallel to the runway.

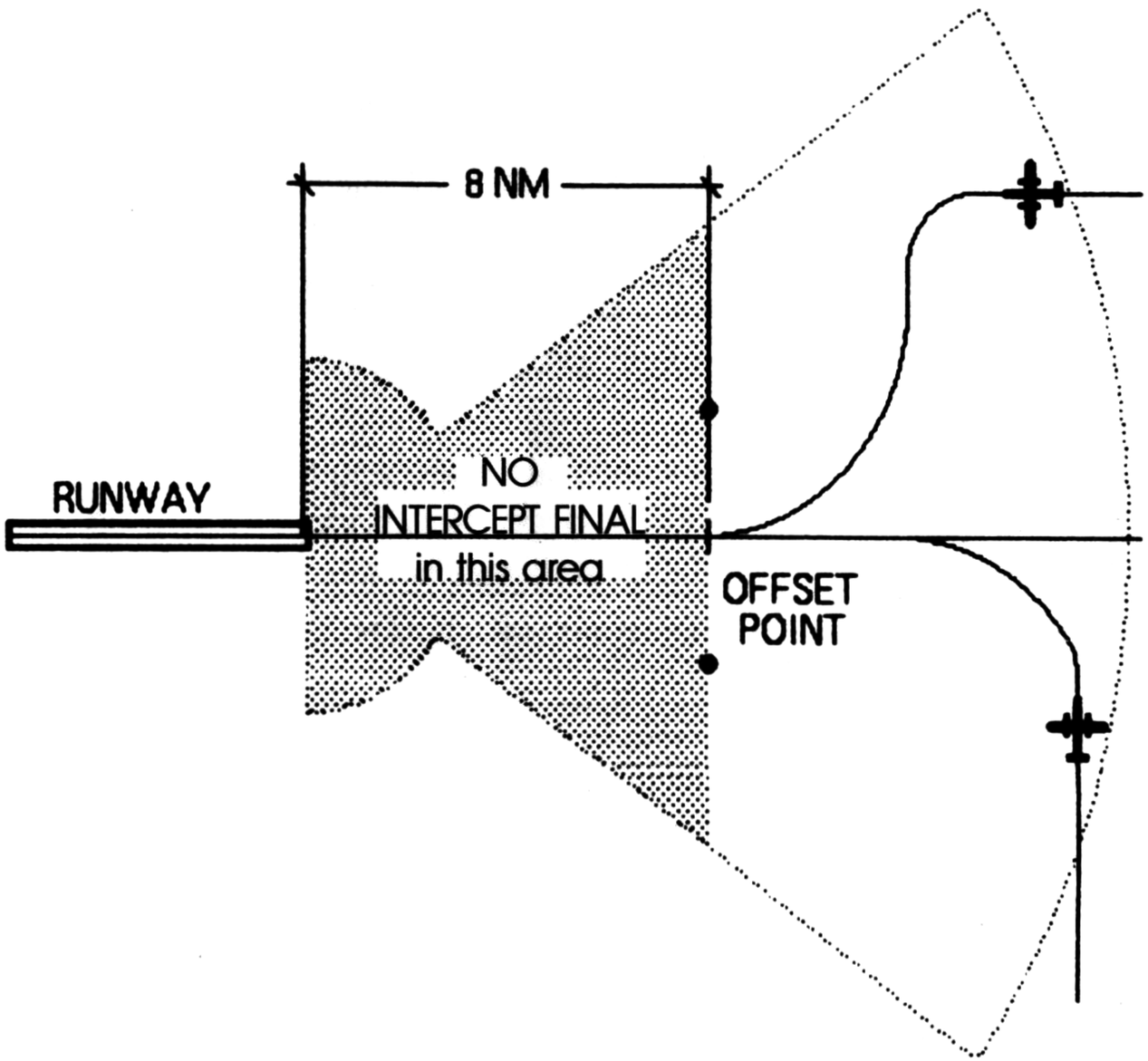
After approx. 5 nautical miles the aircraft reaches the area in which the ILS system can be received. On the instrument the green localiser transmitter, the red glide path marker and the yellow diamond which indicates the touchdown point appear. Shortly after this, FULL PATTERN was activated which resulted in a left-hand turn, a swing at right angles onto heading 090 for the final approach and then, shortly after the green marker began to move to the centre, the aircraft made a further turn left onto the final approach line.

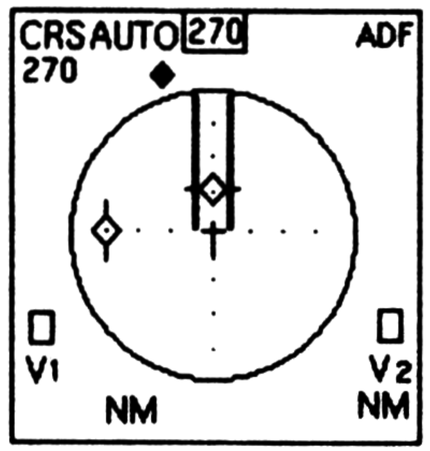
The second aircraft arriving from the east on a heading of 270 activated the FULL PATTERN as soon as it reached the area in which reception of ILS signals is possible. It turned towards the touchdown point and after the offset point turned to the left at a right angle to the final approach line to intersect this. Shortly before the landing both aircraft had the displays shown at the top right.

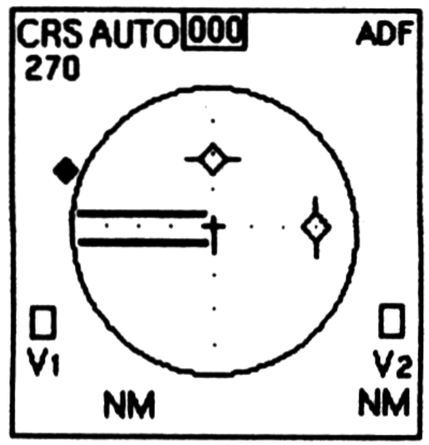
You can activate INTERCEPT FINAL with the [Backspace] key when you reach a position from which you can fly towards the final approach line at 90 degrees. In addition, the distance to the start of the runway must be at least 8 NM as otherwise the ILS is no longer able to align the aircraft along the final approach line.

23

INTERCEPT FINAL



The INTERCEPT FINAL diagram shows two possible approaches for the INTERCEPT FINAL. The second aircraft in the FULL PATTERN diagram would also have been able to make a correct landing with INTERSECT FINAL. The first aircraft in this example was still within the zone which is unsuitable for an INTERSECT FINAL and could only land with a FULL PATTERN.

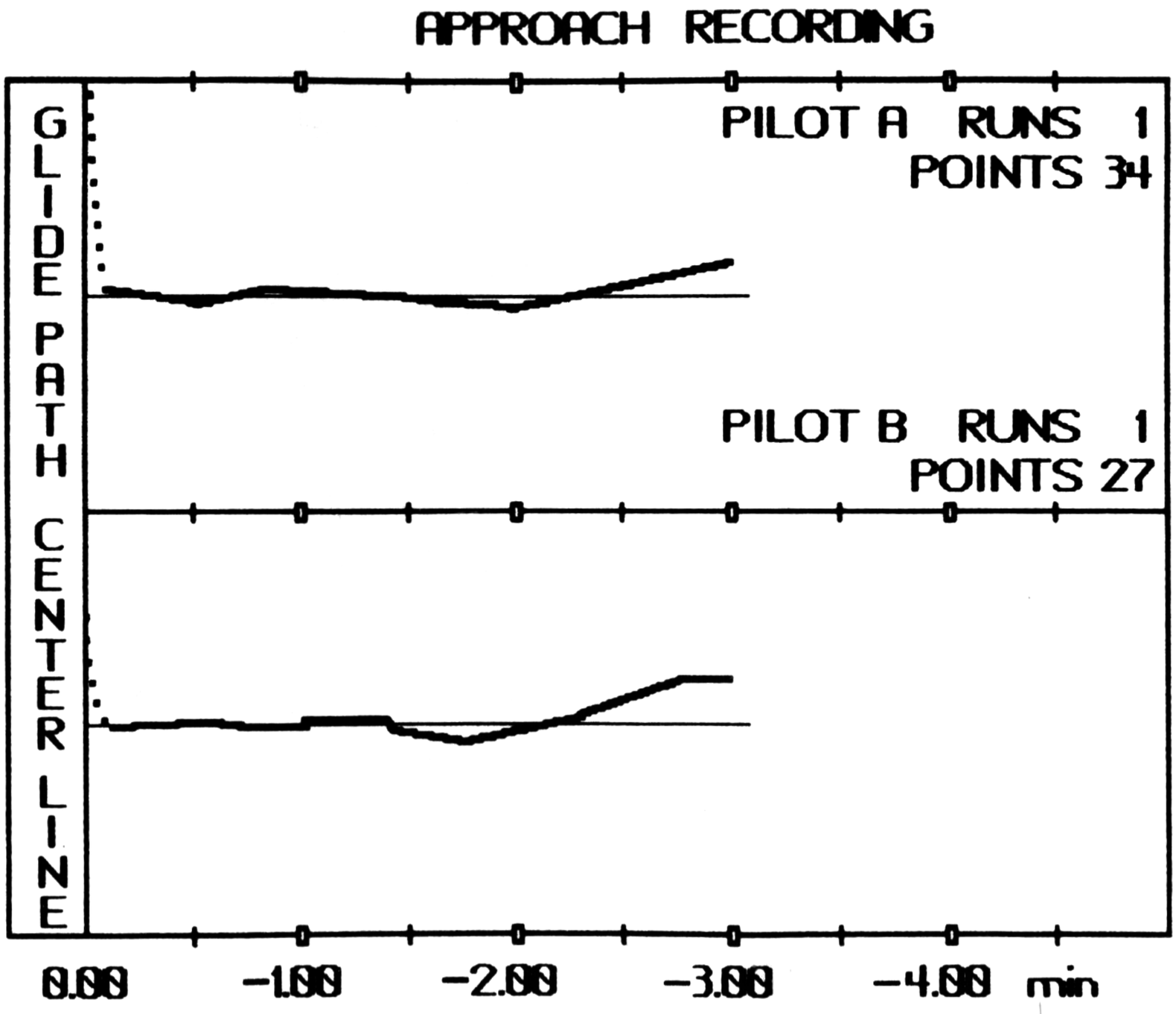
Nevertheless, you should try an INTERSECT FINAL in this area, noting the response of your aircraft when you align it for the FINAL. But do not allow a crash to occur – take control of the aircraft manually and begin a new approach. THIS TRAINING IS ENORMOUSLY IMPORTANT!

For both these ILS procedures it is also necessary for you to be flying at an altitude which allows the automatic systems to bring your aircraft onto the glide path at a maximum vertical speed of 2,000 feet per minute (10 m/s). If you fly too low during the approach the automatic system will adjust your altitude accordingly.

If you approach at too high an altitude the approach geometry will bring you to the touchdown point at too great a height. You must then fly back to the activation area under manual control, move to an acceptable altitude (below 4,000 feet) and start a new attempt.

The graphic display of your approach flight appears after the PERFORMANCE table when you press the [Esc] key.

AR


APPROACH RECORDING
PILOT A RUNS 1
POINTS 34
PILOT B RUNS 1
POINTS 27
GLIDE PATH CENTER LINE
0.00
-1.00
-2.00
-3.00
-4.00
min

The upper half shows your vertical deviation from the GLIDE PATH and the lower half shows your horizontal deviation from the CENTRE LINE for the last 4.5 minutes before touchdown. If the line is green this means a deviation of between O and 2.5 degrees. If it is red, the deviation is more than 2.5 degrees.

The right-hand part of the top half lists the number of flights completed and the SCORE POINTS for both pilot 'A' and 'B'.

# THE ELECTRONIC FLIGHT CONTROL SYSTEM EFCS

The electronic flight control system EFCS is switched on and off with the [E] key. The monitor 'E' above the artificial horizon lights up in blue when the system is active.

The main difference between EFCS and the manual mode is that in the EFCS mode the movements of the joystick tell the controlling computers the flight manoeuvre required – turning, ascending, descending – and the computers then carry out the 'aerodynamic' control procedures – rudder adjustment, centring, opposite rudder, holding the course. This frees the pilot from having to directly co-ordinate the control movements manually, making his life much easier.

## EFCS functions

– Controlling engine power

At critical speeds (close to stall speed) the EFCS automatically adjusts the engine power and reduces any climbrate until a safe speed is achieved.

– Switching from manual to computer control

When you activate the EFCS you no longer control the aircraft directly with the mouse or the joystick but simply specify reference values with the mouse or the joystick which are then executed by the automatic system.

**IMPORTANT NOTE!**
**DURING THE LANDING THE EFCS IS DE-ACTIVATED**
**AT 100 FEET ABOVE GROUND!**

From this point on, you must fly the aircraft by hand and brake the sink rate prior to touchdown. Otherwise the airplane may even crash before it reaches its touchdown point. A crash will certainly happen if your vertical speed is too high (above 600 ff/min = 3 m/sec)!

If the EFCS is active, you set the required rates of climb or descent by moving the mouse or joystick backwards or forwards. The value is displayed digitally on the vertical speed display (see Fig. 3 [10]). The EFCS executes the appropriate manoeuvre.

The BANK angle is adjusted by moving the mouse or joystick to the left or right. You can see the bank angle on the rudder position display (Fig. 3 [12]).

## Other constant automatic functions

– STALL WARNING

If your aircraft is flying at too low a speed or if the rate of climb is too high for the engine power used, the flow of air across its wings may be collapse. This will result in a sudden loss of lift which can lead to a crash.

A STALL WARNING is given both by an acoustic signal and the red warning lamp 'ST' above the artificial horizon.

– PITCH LIMITATION

To avoid critical situations the automatic system limits the pitch of the aircraft (the angle around its lateral axis) to 30 degrees up (nose up) and 15 degrees down (nose down).

– BANK ANGLE

For the same reason the automatic system limits the maximum bank angle to 45 degrees.

– FLAPS AND SLATS

Both these devices are controlled manually or automatically by the ILS. There ar five settings (0–4) which can also be selected with the function keys [F1] to [F5]. Note, that in the air position 1 activates only the SLATS.

– Auto-retraction of slats and flaps

At a speed of more than 210 knots the flaps and slats are retracted automatically to avoid damage.

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| F 1 | F 2 | F 3 | F 4 | F 5 |
|---|---|---|---|---|
| SLATS<br>FLAPS<br>retracted | SLATS<br>FLAPS<br>Position 1 | SLATS<br>FLAPS<br>Position 2 | SLATS<br>FLAPS<br>Position 3 | SLATS<br>FLAPS<br>Position 4 |

| KEY | SLATS | FLAPS | FLIGHT SEGMENT | INDICATION |
|---|---|---|---|---|
| **F 1** | 0° | 0° | CRUISE<br>HOLDING | |
| **F 2** | 18° | 0° | HOLDING<br>APPROACH | |
| **F 3** | 22° | 15° | APPROACH | |
| **F 4** | 22° | 20° | APPROACH<br>LANDING | |
| **F 5** | 27° | 35° | LANDING | |

# EVALUATION

An evaluation of your flight appears on a display after your airplane has come ta a standstill after landing.

The following five points are used:

**APPROACH: Max. points 100**

The accuracy of your flight on the centre line and the glide path, i.e. the green and red markers should preferably always have been kept exactly at the centre of the navigation circle.

**BANK: Max. points 100**

The banking angle on touchdown may not be so high that one of the wing tips could touch the ground. The ideal situation is no banking angle at all and the result would then be 100%. Every degree reduces the result by 4%, so that a deviation of 25 degrees would result in zero points and a crash.

**HEADING: Max. points 100**

On touchdown, a deviation of 1° from the landing course reduces the relevant points scored by 10%. With 10 degrees deviation this would result in zero points. If your A320 goes off the runway at a speed of more than 50 knots a crash is inevitable.

**TOUCHDOWN POINT: Max. points 100**

Three criteria are used for evaluating this point:

a) How far behind the beginning of the runway does your airplane actually touch down. Your score for 0 – 600 m behind the beginning of the runway is 100%. From 601 m onwards 1% is deducted for every four metres. So if you touch down 1,000 m behind the beginning of the runway your landing scores zero.

b) How far off the centre line is your airplane during an otherwise correct approach? 2% is deducted for every metre you are off the centre line.

c) How many times does your airplane touch down before finally staying down? 25% will be deducted from your score for each "bounce". So if you make contact with the ground twice your score will be reduced by 25% accordingly.

If, for example, first contact with the ground is made 3 m away from the centre line with a heading error of 2° and a vertical speed error of 100 feet (deductions therefore 6% + 20% + 10% = 36%) but the second contact with the ground is exactly on the centre line, at the correct heading, with no vertical speed error and within the first 600 m behind the beginning of the runway, only 25% will be deducted for you having made contact with the ground twice.

This very simple but extremely unlikely example is intended for illustration only.

**VERTICAL SPEED: Max. points 100**

A vertical speed of 200 feet per minute (1 m/s) or less will score 100%. Your score is reduced by 1% for every 10 feet/minute more, so that at 600 feet/minute you will have 400/10 = 40% deducted.

However, a landing is only successful if none of the individual scores lies below 66%. If all the individual scores are above 66% the overall score is the average of all five individual scores.

In the SCORING mode the SCORE POINTS calculated according to a special algorithm are added to your logbook. However, your score in the logbook is reset to zero each time you crash your aircraft!

A crash is considered to have occurred if you exceed the minimum permitted score for any one of the above individual points (except APPROACH). The crash limits for individual points are as follows:

| | |
|---|---|
| BANK | 25 degrees or more |
| HEADING | 4 degrees or more |
| TOUCHDOWN POINT | 136 m or more beyond the beginning of the runway or<br>17 m or more off the centre line<br>More than one bounce |
| VERTICAL SPEED | 540 feet/minute or more |

Further causes of a crash are:

- Negative pitch, i.e. the nose touches down first
- Landing gear not extended before landing
- Touchdown off the runway
- Taxiing off the runway or taxiway at more than 50 knots
- Fuel used up before landing

## EVALUATION RANGE

Two conditions must be fulfilled for the evaluation of the approach flight to begin:

**YOUR AIRPLANE MUST BE WITHIN RANGE OF THE ILS TRANSMITTER**

**AND**

**IT MUST BE APPROACHING THE AIRPORT**

Please check the four versions in the following diagram.

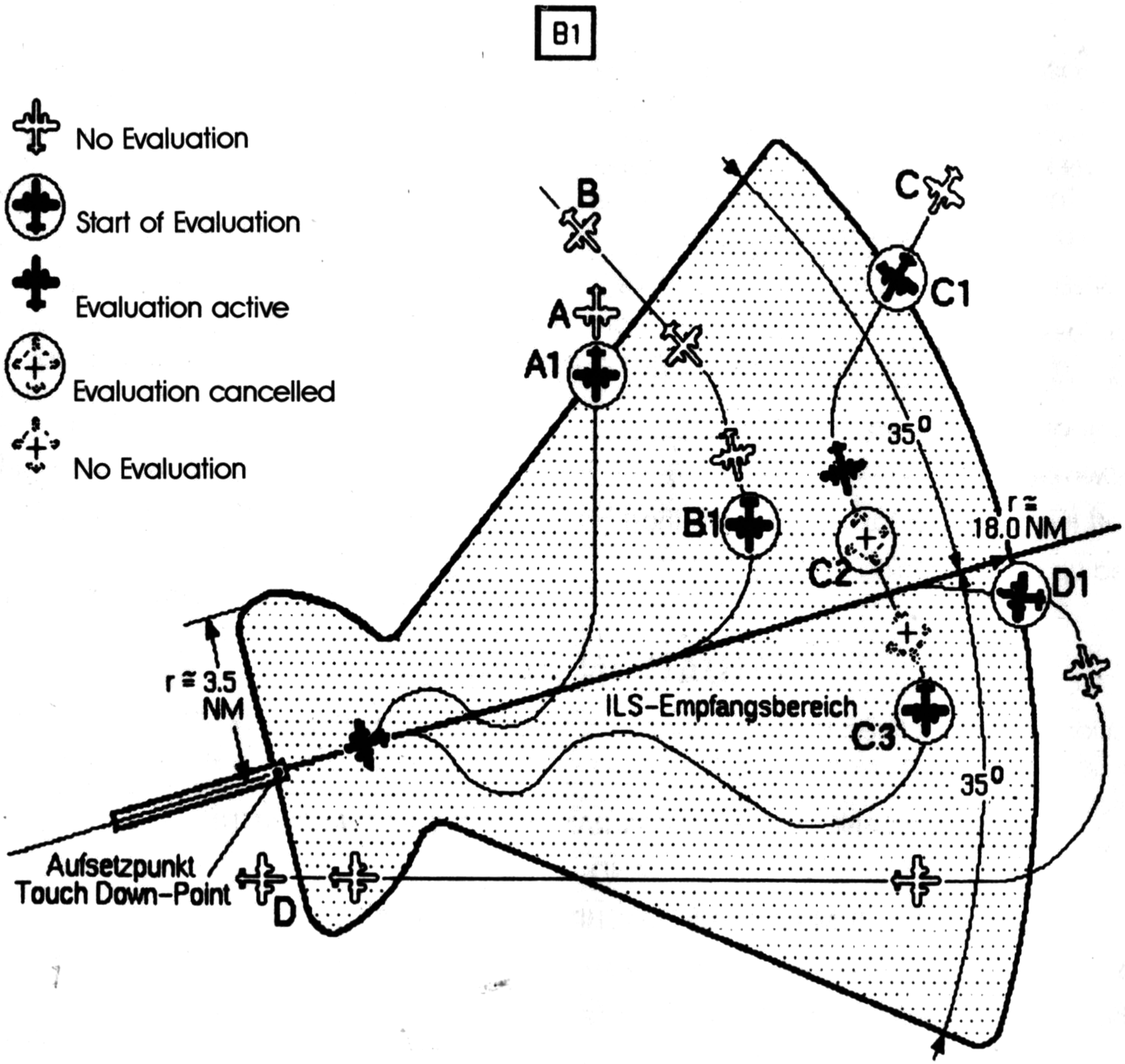
No Evaluation

Start of Evaluation

Evaluation active

Evaluation cancelled

No Evaluation



A: Aircraft 'A' is approaching the ILS signal reception area and reaches it at point 'A1'. This is where the evaluation starts. The aircraft is approaching the airport so that the evaluation is continued without interruption even if the aircraft reaches its final approach line only after making some steep turns. This will not produce a particularly good score in the 'APPROACH' category.

B: Aircraft 'B' is flying towards the ILS signal reception zone, which it in fact reaches, but is flying away from the airport. Consequently no evaluation takes place yet. Only from point 'B1' onwards does the aircraft turn towards the airport and the evaluation thus begins at that time. The smooth turn onto the final approach line will give a good score if the glide path is also followed well.

C: Aircraft 'C' reaches the ILS signal reception area at point 'C1' and is flying towards the airport, so evaluation begins. Then the aircraft turns to the left towards the final approach line but travels so far that it is in fact flying away from the airport again. The evaluation score is set to ZERO at that moment.

A new evaluation only begins when the aircraft reaches the point 'C3' after turning towards the airport again. However, due to the irregular approach the score achieved for this approach will probably not be very high.

D: Aircraft 'D' also reaches the ILS signal reception area but is always flying away from the airport. It even leaves the reception area and returns to it a short time later. No evaluation is therefore possible. Only after changing course through 180 degrees does the aircraft reach the ILS signal reception area at point 'D1' and approaches the airport for the first time.

A clean turn onto the final approach line, i.e. even better than shown here, will give a very high score if at the same time the glide path is followed accurately.

# TRAINING MODE

In the TRAINING mode you can do everything you have learned during your training flight. At the beginning you should use all the electronic aids until finally you can do without one or more of them. The experience and skill you achieve in this mode will be very beneficial for you in the SCORING and MATCH modes.

You can choose the following yourself:

| | |
|---|---|
| – AIRPORT | From the list in the Appendix |
| – WEATHER | Visual (VMC) or instrument flying conditions (IMC) |
| – LONG APPROACH | Via one or more NAV stations or |
| – SHORT APPROACH | In the approach 9 NM from the touchdown point |

You can switch between 'DAY' and 'NIGHT' with the [N] key as often as you wish during the TRAINING flight. You can also adjust your CEILING, PILLOW and VISIBILITY conditions via the input unit.

When you are flying on your instruments the weather forecast gives you the ceiling and the pillow in feet. 'EIGHT OCTAS' means eight eighths cloud cover, i.e. clouds obscure all the sky. The meaning of flat calm, air pressure and 'NO SIG' have already been explained.

The approach and the landing are evaluated as described in the chapter on evaluation. The graphic display of your approach shows you your horizontal and vertical deviation from the optimum glide path. Continue with the [Esc] key.

No personal log is kept.

If after a successful landing you wish to use up all your remaining fuel you can of course increase your speed again and fly around the airport to attempt more landings until your fuel runs out.

To do this, do not brake your airplane to a standstill after touchdown but steer it to the end of the runway at a speed of 10 to 15 kts, turn through 180 degrees, align it on the centre of the runway

and take off again. Naturally you can also steer the aircraft to any other runway but you must ensure you never exceed the maximum permitted speed of 50 kts outside runways and taxiways.

## SCORING MODE

In the SCORING MODE the airport, the time (day or night) and the weather conditions are selected randomly and are therefore specified by the program. Sometimes this can make life almost impossible, for example flying on instruments only (IMC), 200 feet CEILING and heavy ground fog (VISIBILITY Level 7). Furthermore, always a LONG approach must be made.

The only entry you need to give is your name. A logbook is then created for your results so that you can judge your progress at any time.

For this purpose you must ensure that your diskette is write-enabled, as otherwise the program cannot create the logbook on the disc!

The SCORE POINTS recorded in the logbook are given from the total achievements in evaluation points. Any points you achieve over 66% are added. The maximum is therefore 5 x 34 = 170 points per landing.

The graphic display of your approach shows your horizontal and vertical deviation from the glide path. Continue by pressing [Esc].

If you experience a CRASH the logbook score is reset to zero.

If you use automatic facilities, the following SCORE POINTS are deducted:

AUTO ILS, [Return] or [Backspace] key:
If you use the auto pilot for the landing you will naturally have NO points credited.

SEEK/HOLD HEADING, [Help] key:
If you use the automatic steering system, 25 points will be deducted from your score.

HOLD SPEED, [5] key on the numeric keypad:
If you use the automatic hold speed facility also 25 points will be deducted from your score.

EFCS, key [E]:
Also the EFCS will cost you 25 points.

But there is also a good side to all this deduction of points: You cannot have more points deducted than you have already scored. So, in contrast to your bank account, you cannot go into the red ...

**BUT:**
**A CRASH CANCELS THE WHOLE SERIES!**

## MATCH MODE

In the MATCH mode you fly alternately against an opponent to land at the same airport under exactly the same conditions. The series consists of a maximum of 5 flights to 5 different airports. You always carry out a short approach pattern.

Your aim is to be better than your opponent. The two players are called 'PLAYER A' and 'PLAYER B'.

The conditions – a random choice of airports, weather conditions, time (day/night), evaluation, deduction of points and crashes – are the same as in the SCORING mode.

Start with the message:

YOU ARE ON FINAL 9 MILES OUT.
CONTINUE YOUR ILS APPROACH ON RUNWAY XX.

You are therefore right next to the final approach line 9 miles (approx. 16 km) from your touchdown point. Carry out your ILS approach to the runway stated.

The match is executed as follows:

| Airport/series | Flight | Pilot 'A' | Pilot 'B' | Score points |
|---|---|---|---|---|
| 1 | 1 | Flying | Observing | x |
| | 2 | Observing | Flying | x |
| 2 | 3 | Observing | Flying | x |
| | 4 | Flying | Observing | x |
| 3 | 5 | Flying | Observing | x |
| | 6 | Observing | Flying | x |
| 4 | 7 | Observing | Flying | x |
| | 8 | Flying | Observing | x |
| 5 | 9 | Flying | Observing | x |
| | 10 | Observing | Flying | x |

End of game – the pilot with the best SCORE is the winner. You can see that players alternate between simply observing and learning first and then actually flying the aircraft.

You can stop the match at any time simply by pressing [Esc] if both players want to do less than five flights.

Both flights of each series must be completed. If the first pilot crashes, the second pilot must show that he can master the difficulties involved in that flight. If he is successful, he is the winner. If he is unsuccessful, the pilot with the higher number of points wins. If the first pilot lands successfully and the second pilot crashes, naturally the first pilot is the winner. Actually a crash in the series brings the game to an end but you as the players can decide yourself whether you wish to continue or finish the game simply by pressing [Esc].

The results are not recorded in the logbooks.

# QUICK REFERENCE MAP

Through carrying out a large number of training flights in the TRAINING mode you have gained the essential knowledge and skills which allow you in the SCORING mode to bring your airplane back down to the ground safely under difficult weather conditions, just like a real aircraft Captain. And in the MATCH mode, too, you had to prove your skills again and again.

You have therefore mastered the most difficult aspect of flying, i.e. landing your correctly.

Doesn't that now make you want to be allowed to fly an AIRBUS A320, one of the most modern aircraft operated by Lufthansa and British Airways, to long-haul destinations?
Carrying up to 150 passengers and your crew, and packed full of freight?

With you responsible for calculating your fuel requirements and your routes all over Europe, on long-haul flights, too, along specified air corridors, at altitudes of up to 40,000 feet, from one radio beacon to another?

With the possibility of making as many intermediate landings for refuelling as are necessary in the training mode?

And, last but not least, with a chance of becoming the CHIEF PILOT of your AIRBUS A320?

With the instruction manual you received a Quick-reference map showing all the airports and radio beacons in Europe from which you can start and to

which you can fly with the "AIRBUS A320" flight simulation programme.

Airports in the AIRBUS A320 APPROACH TRAINER are shown by their ILS frequencies and landing courses, eg. 109.90 / 255 for Stuttgart. The relevant radio beacons are shown by their frequencies and codes, eg. 112.50 TGO for NDB TANGO.

As this map is not to scale you cannot use it for measuring distances and courses. It is intended only as a guide so that you can fully appreciate the many facilities offered by your AIRBUS A320 Flight Simulator, so that you can progress, through its training facilities and by eventually completing the 70 mandatory flights, from STUDENT PILOT to PILOT, SENIOR PILOT and COMMANDER right through to CHIEF PILOT.

**Take control of the cockpit of your AIRBUS A320!**

**Your passengers and crew await you!**

**We wish you much success and always**

**H A P P Y  L A N D I N G !**

## ANNEX

With the APPROACH TRAINER you may use an AMIGA-specific ANALOGUE JOYSTICK in PORT 2.
You may also use a PC-type ANALOGUE JOYSTICK. These joysticks are easy to obtain, they come in greater variaties and some are less expensive compared to AMIGA-specific ones.
The PC-type joystick goes also into PORT 2. However, you need an INTERFACE-CONVERTER to do that. Such adapters are available, but sometimes hard to find. Therefore we provide you with the schematic for it.

You need no great experience to build it, since it is simply connecting some wires from one plug to another. Just make sure you connect the right numbers and avoid crossconnections between neighbouring pins.

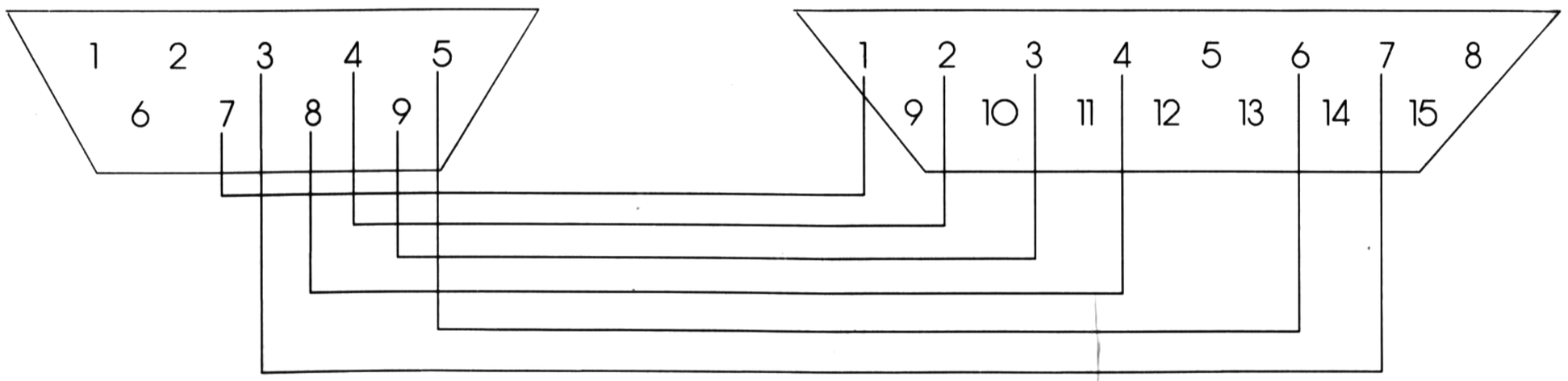
You need

- 1 x 9-pin DSUB-plug ("female")
- 1 x 15-pin DSUB-plug ("female")
- approx. 10 cm multi-wire cable, min. 6 wires
- and eventually a friend, who knows how to use a soldering iron (max. 20 Watts).

The schematic:

**AMIGA GAME PORT**
**(9-pin DSUB-plug)**

**PC-ANALOGUE STICK**
**(15-pin DSUB-plug)**



The pin numbers are marked on the rear side of the plugs!

To select the control device press [J]-key until the CONTROL-Indicator (Picture 3, Number 4) shows the desired mode:

BLACK = MOUSE
BLUE = SWITCH-type JOYSTICK
YELLOW = GRAVIS AMIGA MOUSESTICK (NOT the GRAVIS PC-type joystick)
WHITE = ANALOGUE JOYSTICK

If the ANALOGUE joystick is selected:

- Set the control stick and the potentiometers/trimmers (if present) mechanically to a neutral position.
- Press [T]-key. Check the deflections in all directions to cover the full deflection range.
- If necessary, adjust the trimmers and repeat the second step.

If you move the joystick really fast (remember, we are in an airliner, not in a fighter!), neutral position may be disturbed. You can re-adjust it by pressing [T] at any time.

**IMPORTANT NOTE**
For technical reasons in conjunction with the analogue joystick the INPUT PANEL is now activated in ALL CONTROL MODES by the

**LEFT MOUSE BUTTON.**

The right mouse button has no function anymore.